TECHNICAL STANDARDS AND SPECIFICATIONS MANUAL FOR THE RURAL GAS PROGRAM

Design, Construction and Operation
of
Natural Gas Distribution Systems
in
Rural Alberta

Second Edition

Alberta
TRANSPORTATION AND UTILITIES
GAS DISTRIBUTION BRANCH

FOREWORD

This second edition of the Technical Standards and Specifications Manual replaces the original 1982 edition. While the intent and the general content of both editions are similar, this second edition is drafted in a less formal style and has of course been updated to reflect changes to technical standards which have occurred since 1982.

This manual is issued in accordance with the provisions of section 3(f) of the Rural Gas Regulation (Alberta Regulation 263/82) and should therefore be considered as having the same force and effect as the Regulation.

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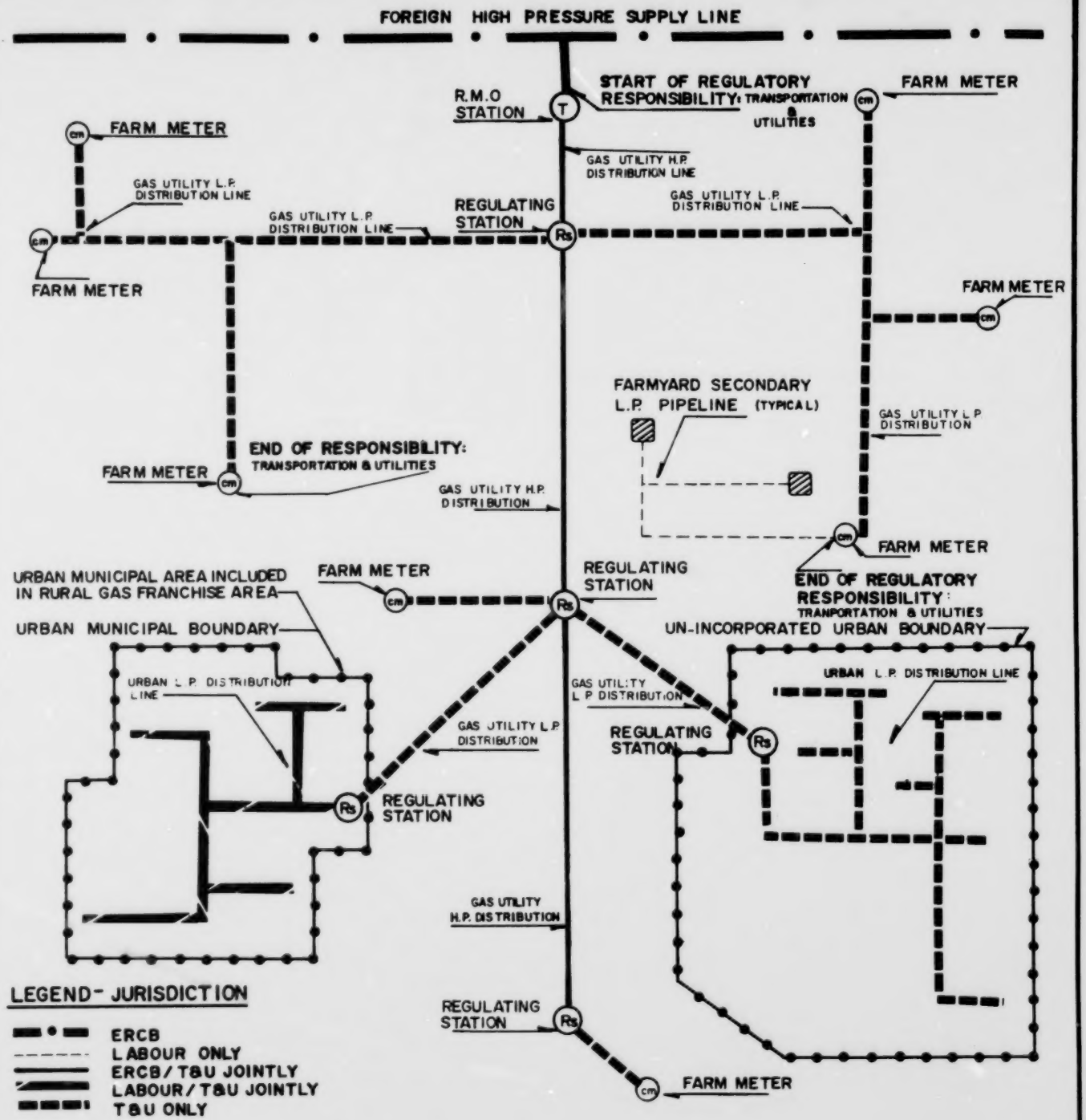
1. Scope and Application

The scope of this manual is generally consistent with Figure 1.1 and includes:

(a) any part of a gas distribution system within a franchise area which has been approved and issued under the authority of the Rural Gas Act;

(b) any gas distribution pipeline which operates at a pressure of 700 kilopascals (100 psig) or less, is located outside an incorporated urban area, and is defined as a "low pressure distribution pipeline" within the meaning of the Rural Gas Act.

This manual covers the key aspects of design, construction and operation which the Branch considers necessary for the orderly and effective development of gas distribution systems.



SCOPE OF MANUAL

FIGURE 1.1
N.T.S.

Alberta
TRANSPORTATION AND UTILITIES

2. Reference Legislation, Regulations and Standards

The design, construction and operation of distribution systems are subject to a wide variety of statutes and regulations issued by the Government of Alberta and the Government of Canada. In addition, an extensive number of publications by the Canada Standards Association (CSA), the Canadian Gas Association (CGA) and other organizations should be consulted.

The latest edition of the CSA standard published as "CAN/CSA-Z184: Gas Pipelines Systems" should be considered as the principal guideline for the design, construction and operation of distribution systems. Regulations covering gas pipeline systems in Alberta require compliance with the CAN/CSA-Z184 standard, although these regulations include some variations to provisions in the standard. (To illustrate this point, the minimum depth of cover over pipelines is specified as 60 centimetres in the CAN/CSA-Z184-M86 standard while, for example, the Pipeline Regulations specify a minimum depth of cover of 80 centimetres.) Where such conflicts exist, the applicable regulation should be considered as over-riding the standard in all cases.

Since the scope of this manual covers some distribution pipelines which fall within the jurisdiction of both the Branch and the Energy Resources Conservation Board, it should be assumed that, where dual jurisdiction exists, the following principles should apply:

(a) where a minimum specification issued by the Board exceeds a specification contained in this manual, the Board's specification shall prevail;

(b) similarly, where a minimum specification contained in this manual exceeds a specification issued by the Board, the specification in this manual shall prevail.

3. Definitions

1. "Branch" means the Gas Distribution Branch of the Department of Transportation and Utilities.
2. "Distribution system" means an integrated network of distribution pipelines.
3. "Distribution pipeline" means a pipeline used to transport and deliver gas to consumers.
4. "Distributor" means the person or corporation that owns a distribution pipeline or distribution system.
5. "Ground disturbance" means any work, operation or activity that results in a disturbance of the earth including, without limitation, excavating, digging, trenching, plowing, drilling, tunnelling, augering, backfilling, blasting, topsoil stripping, land levelling, peak removing, quarrying, and clearing and grading, but does not include:
   (i) except as otherwise provided in sub-clause (ii), a disturbance of the earth to a depth of less than 30 centimetres that does not result in a reduction of the earth cover over the pipeline to a depth that is less than the cover provided when the pipeline was installed, or
   (ii) cultivation to a depth of less than 45 centimetres below the surface of the ground.
6. "High pressure pipeline" means a distribution pipeline which is designed to operate or is intended to be operated at a pressure in excess of 700 kilopascals.
7. "Low pressure pipeline" means a distribution pipeline which is designed to operate or is intended to be operated at a pressure of 700 kilopascals or less.
8. "Main" means the part of a distribution system upstream of service lines.
9. "Service Line" means a distribution pipeline dedicated to serving a single consumer.

4. Design

4.1 General

In designing a new distribution system, or an addition or improvement to an existing system, a certain amount of judgement and flexibility is required. For example, some judgement is usually required in deriving the peak hour design load to serve consumers' needs. This is particularly so when the utilization of the appliances which will consume the gas cannot be forecast with a sufficient degree of accuracy. An example of the need for flexibility is a loop line which is required to decrease the pressure drop across the system. Often, a number of alternative locations exist for this loop while the loop itself can be altered in relation to its length and diameter.

In such cases, the Branch will acknowledge and generally accept the fact that the designer may select a design option of his or her own choosing. However, the Branch may request the use of an alternative design where in its opinion the alternative will be more effective and cost-efficient.

4.2 Establishing Peak Hour Design Loads

In the design of a distribution system, pipe sizing is influenced primarily by the maximum hourly volume of gas which the system is required to transport. Accordingly, if the designer is to ensure that the system design will meet — but not greatly exceed — the requirements of the consumers served by the system, peak hour design loads must be derived with a certain amount of care.

The volume of gas which the system must transport is determined from a combination of the following criteria:

4.2.1 Maximum Connected Load

The maximum connected load of the individual consumer can be calculated by establishing and tabulating the burner input rating of all appliances. This assumes the possibility that, for example, a consumer may operate a furnace, water heater, clothes dryer, oven and all stove top burners at the same time. While this may not happen too often, this total potential load should be used to size the service line and, of course, the gas meter.

Establishing the maximum connected load for purposes of sizing the service line and meter is not quite so simple in cases where, for example, special agricultural equipment such as irrigation engines and grain dryers are served from the same service line and meter. Due to the seasonal utilization of this equipment, it is unrealistic to simply total the maximum burner rating of appliances and equipment. In such cases, the designer must apply some judgement.

4.2.2 Peak Design Loads

The peak design load is the hourly load which is used to size system mains and is derived by applying a "coincidence factor" to the maximum connected load. The value of the coincidence factor varies indirectly with the number of consumers being served from the main which is being sized — the greater the number of consumers, the smaller the value of the coincidence factor. For example, a main serving a large group of consumers may be required to transport a peak design load of perhaps as little as only 50% of the total connected load of that group of consumers due to such factors as the intermittency of gas demand for heating load, the variations which exist in the personal habits of consumers, and the burner rating of furnaces relative to building heat loss. In this example, the coincidence factor of 0.5 would ensure that the main would be sized to carry sufficient but not excessive capacity to meet the needs of consumers at peak flow conditions.

4.2.3 Establishing Coincidence Factors

It is the designer's responsibility to establish realistic coincidence factors for sizing mains. The designer will recognize that each distribution system is unique in this respect due to the significant variations which exist between the number and type of consumers, the influence of seasonal loads, industrial loads which are not sensitive to ambient temperature changes, and other factors. Since the only detailed studies which have been conducted on the subject of coincidence factors have focused on systems serving large cities, there are no substantive industry guidelines available to assist the designer in deriving coincidence factors for a rural gas distribution system. A designer should, therefore, establish his own guidelines based on a comparison between the theoretical pressure drop from calculation and the actual pressure drop being experienced at the lowest ambient temperature experienced.

4.2.4 Consumer Load Surveys

Where a consumer load survey is to be conducted to provide the designer with maximum connected loads and to permit extrapolation of peak design loads, the form illustrated in Figure 4.1 or an acceptable equivalent should be utilized.

Care must be taken in establishing future load requirements and the requirements for large load equipment since this information has a significant impact on system sizing and costs. While allowance should be made for future additional loads if appropriate, the load established should be a realistic projection of the consumer's future requirements. Similarly, large load equipment should be carefully analyzed to ensure that the volume of gas set aside for this requirement is sufficient but not excessive.

4.2.5 Degree-Day Method

Where it is necessary to consider the loads of existing consumers (for example, designing a loop line), the peak design load for those consumers may be reasonably estimated by considering the consumers' actual consumption for a specific billing period and the number of degree-days locally for that same period. A discussion on this method can be found in Appendix A.

The advantage of the degree-day method is that it is based on actual consumption and eliminates the need for new load surveys. Its use is, however, essentially limited to existing consumers who have generated a billing history and whose peak design load is primarily influenced by ambient temperatures i.e. space heating purposes.

4.3 Sizing of Distribution Systems

As noted in section 4.2, the principal factor influencing the sizing (i.e. pipe diameter) of a distribution system is the peak design load which the system is required to transport. The next most significant factor is the mathematical model used to calculate dynamic pressure loss over a segment of pipeline and hence determine its size. A number of suitable models exist which are applicable to rural gas system design including the General Flow Equation and the IGT Flow Equation. These models, and any other comparable models which utilize the Reynolds Number for prediction of flow conditions within a distribution pipeline, are generally acceptable to the Branch.

4.4 General Design of Distribution Systems

A designer will usually have many options available for routing and sizing a new distribution system or an addition to a system to improve capacity. The location of consumers in relation to the gas source, the ability to gain right-of-entry to lands, and the terrain conditions in the area are the principal factors which the designer must consider.

Improvements to existing distribution systems to overcome inadequate flow capacity should consider the following options:

(a) A simple loop line paralleling the existing system main for a sufficient distance. The segment of the existing system to be looped should be carefully selected to ensure maximum impact at minimum cost.

(b) As an alternative to looping, consideration should be given to interconnecting systems.

(c) Crossings of major obstacles such as railways, highways, roads and canals should not be looped unless the existing crossing is in a deteriorated condition or will create a flow bottleneck, or connecting the loop to the existing main at either side of the crossing is impractical or uneconomical due to distance, costs or other factors.

4.5 Routing of Distribution Systems

The routing selected for a new distribution system or an improvement to an existing system should be determined from a combination of the following criteria:

(a) The requirements of any Government body, or any regulatory authority, having jurisdiction over the land, waterway, railway, or roadway affected by the location of pipelines on or adjacent to that property.

(b) The requirements of any landowner whose property will be directly or indirectly affected by the location of pipelines on or adjacent to that property.

(c) The requirements of any owner of a utility line whose pipeline or cable is to be traversed by a distributor's pipelines. In addition, the designer should take account of the effect of adjacent overhead power lines on a steel or aluminum pipeline which is to be located adjacent to that power line.

(d) Any proposal to amend the current use of the land in which it is proposed to locate pipelines.

(e) The sub-surface condition of the land in which it is proposed to locate pipelines. Where it is feasible to do so, location of pipelines in land with sub-surface rock, in either solid or loose formation, should be avoided.

(f) The surface terrain condition of the land in which it is proposed to install distribution pipelines. Where it is feasible to do so, location of pipelines in swamp, muskeg, or bodies of water, or in land which is covered by timber or dense brush, should be avoided.

(g) The possibility of soil erosion or removal. Where necessary, a qualified geotechnical study should be conducted to assist the designer in establishing effective methods of controlling severe instances of potential soil erosion which could adversely affect the operation of pipelines.

(h) The location of all suitable gas sources in relation to the proximity of the majority of consumers to be served from the pipeline system supplied from the gas source.

(i) The ease of access which the location of pipelines may provide for initial construction and for subsequent inspection, maintenance and repair of pipelines. Where it is feasible and within economic reason to do so, pipelines should be located by a "grid system" based on the following principles:

- location in an east-west or north-south direction;
- location at established parallel distances from east-west or north-south roads and fence lines;
- changes of direction at right angles.

(j) The capital cost associated with alternative routes.

4.6 Depth of Cover and Clearance

For normal operational conditions, pipelines should be installed with the following minimum depths of cover:

a) For service lines located within farmyards and other private properties where ground disturbances are minimal, the minimum depth of cover may be 60 centimetres.

b) For other service lines and for mains, the minimum depth of cover should be 80 centimetres.

c) For crossing of highways, roads, railways, canals, watercourses and foreign pipelines or cables, the minimum depth of cover should be determined from Section 4.7.

The minimum clearance to be maintained between a pipeline and any other facility or structure that it parallels or crosses should be in accordance with the latest edition of the CAN/CSA-Z184 Standard.

4.7 Crossings of Other Facilities

The design of any distribution pipeline crossing of highways, roads, railways, canals, watercourses and foreign pipelines or cables must receive the prior approval of the owner, administrator or authorized agent of the right-of-way or facility which is to be crossed. Typical crossing profile designs and dimensions that are acceptable to the Branch are illustrated in Figures 4.2 to 4.7 inclusive.

The depth of cover for buried pipelines at all crossing locations should be determined from a review of operational safety factors which may potentially cause damage to a pipeline. These factors include stress loading, sub-surface materials, special soil cultivation methods within the right-of-way, and potential ground disturbances above or adjacent to the pipeline.

The depths of cover specified in Figures 4.2 to 4.7 inclusive should be considered only as standard dimensions which reflect the operational factors typically found at each type of facility to be crossed. However, it may very often be prudent or necessary to increase the depth of cover to address special factors which may be revealed in consultation with the owner, administrator or agent for the facility being crossed. In particular, planned improvements to highways or roads should be considered and the location and/or the depth of the crossing should take account of any development plans by the road authority. Since the distributor is usually faced with the cost of replacing or lowering its crossing when road improvements take place, it is in the distributor's interests to initiate consultation and hence ensure that the crossing is located and designed so that it will remain undisturbed for its operational lifespan, even if future development takes place at the crossing site. This consultative process applies to the following aspects of highway or road crossing as outlined in Figures 4.2 and 4.3:

(a) The depth of cover under the lowest point (usually the ditch bottom) in the right-of-way which is, as a minimum, either 110 centimetres or 140 centimetres depending on the type of road being crossed (See Figure 4.3). These depths of cover should be adequate for most crossings, but should be increased if, following consultation with the road authority, it is determined that future roadway development plans will necessitate pipe replacement or lowering.

(b) The standard distance of any vertical bends from the edge of the right-of-way or centre-line of the road as specified in Figure 4.3. Where this standard distance is difficult to achieve due to terrain and/or landowner problems, application may be made to the road authority for a lesser distance. However, where approval for a lesser distance is granted by the road authority, the distributor will have to accept the responsibility for the cost of lowering or relocating the pipeline should this be required by future roadway development.

(c) Crossings of undeveloped road allowances should only be made at the nominal installation depth of 80 centimetres following consultation with the road authority and confirmation that the road allowance is unlikely to be developed. If road development is planned, the crossing should be designed and installed to suit the profile of the proposed road.

4.8 Pipelines Parallel to Local Municipal Roads Administered By Counties and Municipal Districts

Municipal authorities are required from time-to-time to alter, widen or relocate the rights-of-way of roads which fall under their administration. Where a distribution pipeline exists parallel to and within proximity of the existing right-of-way, the new road design may require that the pipeline be relocated or lowered. While this is often unavoidable, good planning techniques can usually eliminate the need for future relocation or lowering. To facilitate good planning and avoid unnecessary pipeline relocation or lowering, a control area or zone as illustrated in Figure 4.8 should be used in the design of gas distribution systems. For distribution pipelines operating at a pressure of 700 kilopascals or less, the control area concept should not be considered as a minimum distance parallel to and on either side of an existing road right-of-way in which the municipal authority has the inherent right to either approve or reject a pipeline installation. (It should be noted, however, that the Pipeline Act does in fact require that high pressure pipelines to be constructed under that Act shall not be located within 30 metres of the boundary of a municipal road without the approval of the local authority.)

The various control areas illustrated in Figure 4.8 should be used by a designer of a low pressure dis-

tribution pipeline to consider future planning. If an initial design of a low pressure pipeline paralleling a municipal road falls within one of the control areas illustrated, the designer should consider the following options:

(a) redesign the pipeline route — such that it is located outside any control areas — without consulting the municipal authority.

(b) consult with the municipal authority to determine if there is a likelihood that the road may be altered, widened or relocated such that the pipeline would be affected. If necessary, the pipeline route should be redesigned to avoid future conflict with road planning. If consultation with the municipal authority indicates that there is a good possiblity that future road planning should not affect the proposed pipeline route, then that route may be retained.

The basis for the consultative process related to control areas for low pressure distribution pipelines is the mutual and common interests of the distributor and the municipal authority, as well as the need for both parties to demonstrate reasonableness. These aspects are discussed in more detail in Appendix B.

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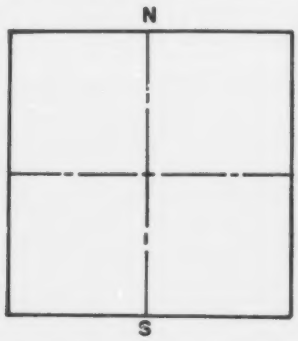
LOAD SURVEY FORM FOR RURAL GAS UTILITIES

NAME OF DISTRIBUTOR: _____ TELEPHONE: _____



NEW SURVEY ☐

RESURVEY Changed ☐ Unchanged ☐

THE DIAGRAM SHOWN REPRESENTS THE SECTION ON WHICH THE FARMSTEAD IS LOCATED. PLEASE INDICATE THE POSITION OF THE FARMSTEAD AND COMPLETE THE INFORMATION BLANKS BELOW.

OWNERS NAME _____ TELEPHONE _____

1/4 SECTION _____ SECTION _____

TOWNSHIP _____ RANGE _____ W. OF _____ MERIDIAN

SURVEYED BY _____

DATE OF SURVEY _____

PRESENT BTU/HR. REQUIREMENTS

APPLIANCE -	TYPE OF BUILDING	BUILDING DIMENSIONS	BASEMENT	NO. OF STOREYS	BTU/HR.
FURNACE			YES NO		
FURNACE			YES NO		
FURNACE			YES NO		
C.H BOILER			YES NO		
			YES NO		
			YES NO		
			YES NO		
WATER HEATER					
WATER HEATER					
CLOTHES DRYER					
STOVE					

FUTURE BTU/HR. REQUIREMENTS

APPLIANCE	TYPE OF BUILDING	BUILDING DIMENSIONS	BASEMENT	NO. OF STOREYS	YEAR	BTU/HR
			YES NO			
			YES NO			
			YES NO			
			YES NO			

LARGE LOAD EQUIPEMENT

GAS ENGINE BHP _____ X 12 000 BTU/HR =

MAXIMUM SEASONAL USE _____ TO _____

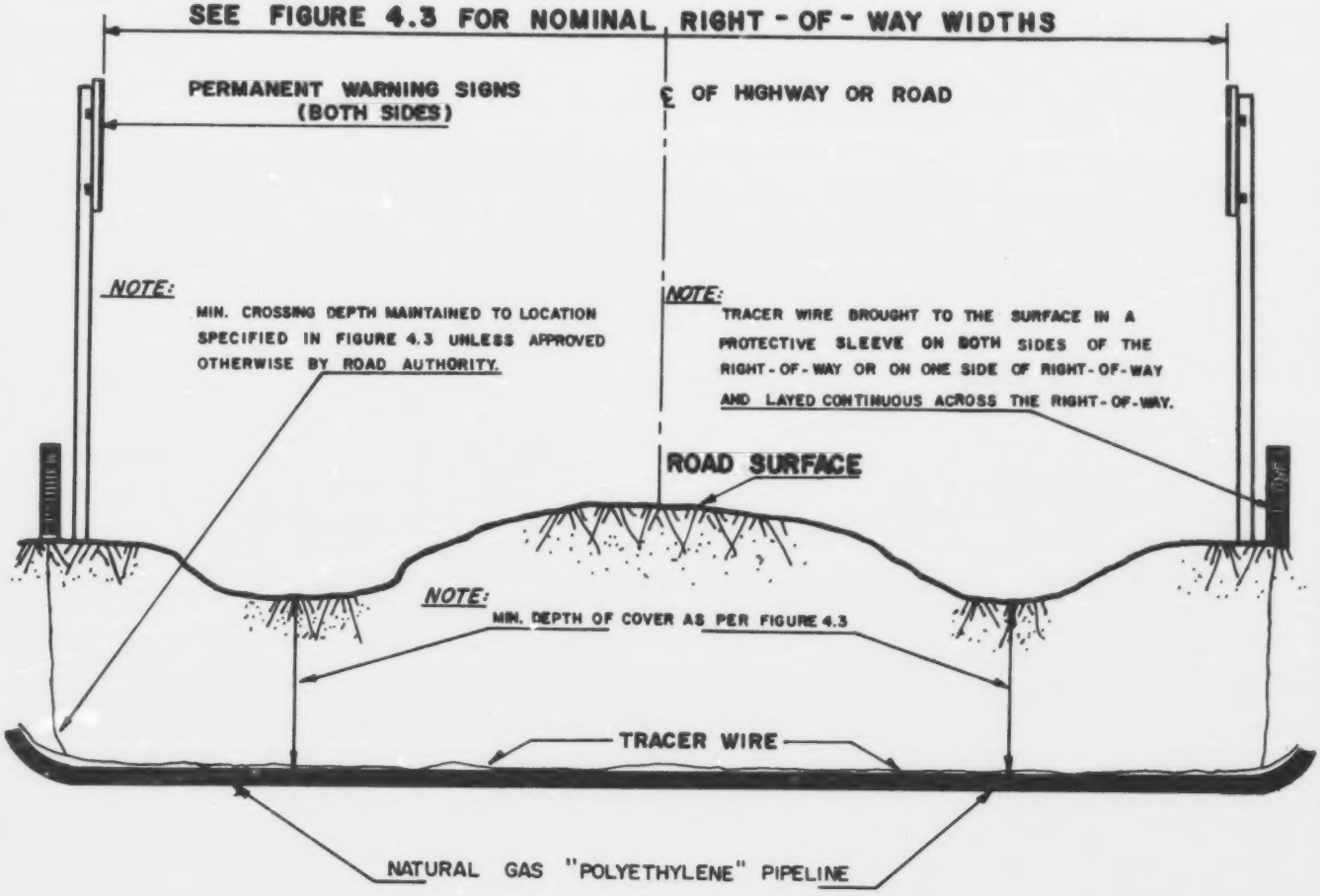
NUMBER OF HOURS IN OPERATION PER DAY = _____ AVERAGE

GRAIN DRYER

MAXIMUM SEASONAL USE _____ TO _____

OTHER (Specify)

REMARKS - EXISTING METER TYPE AND SIZE (IF APPLICABLE) _____


SEE FIGURE 4.3 FOR NOMINAL RIGHT - OF - WAY WIDTHS
PERMANENT WARNING SIGNS (BOTH SIDES)
℄ OF HIGHWAY OR ROAD
NOTE:
MIN. CROSSING DEPTH MAINTAINED TO LOCATION SPECIFIED IN FIGURE 4.3 UNLESS APPROVED OTHERWISE BY ROAD AUTHORITY.
NOTE:
TRACER WIRE BROUGHT TO THE SURFACE IN A PROTECTIVE SLEEVE ON BOTH SIDES OF THE RIGHT - OF - WAY OR ON ONE SIDE OF RIGHT - OF - WAY AND LAYED CONTINUOUS ACROSS THE RIGHT - OF - WAY.
ROAD SURFACE
NOTE:
MIN. DEPTH OF COVER AS PER FIGURE 4.3
TRACER WIRE
NATURAL GAS "POLYETHYLENE" PIPELINE

TYPICAL HIGHWAY OR ROAD CROSSING

FIGURE 4.2
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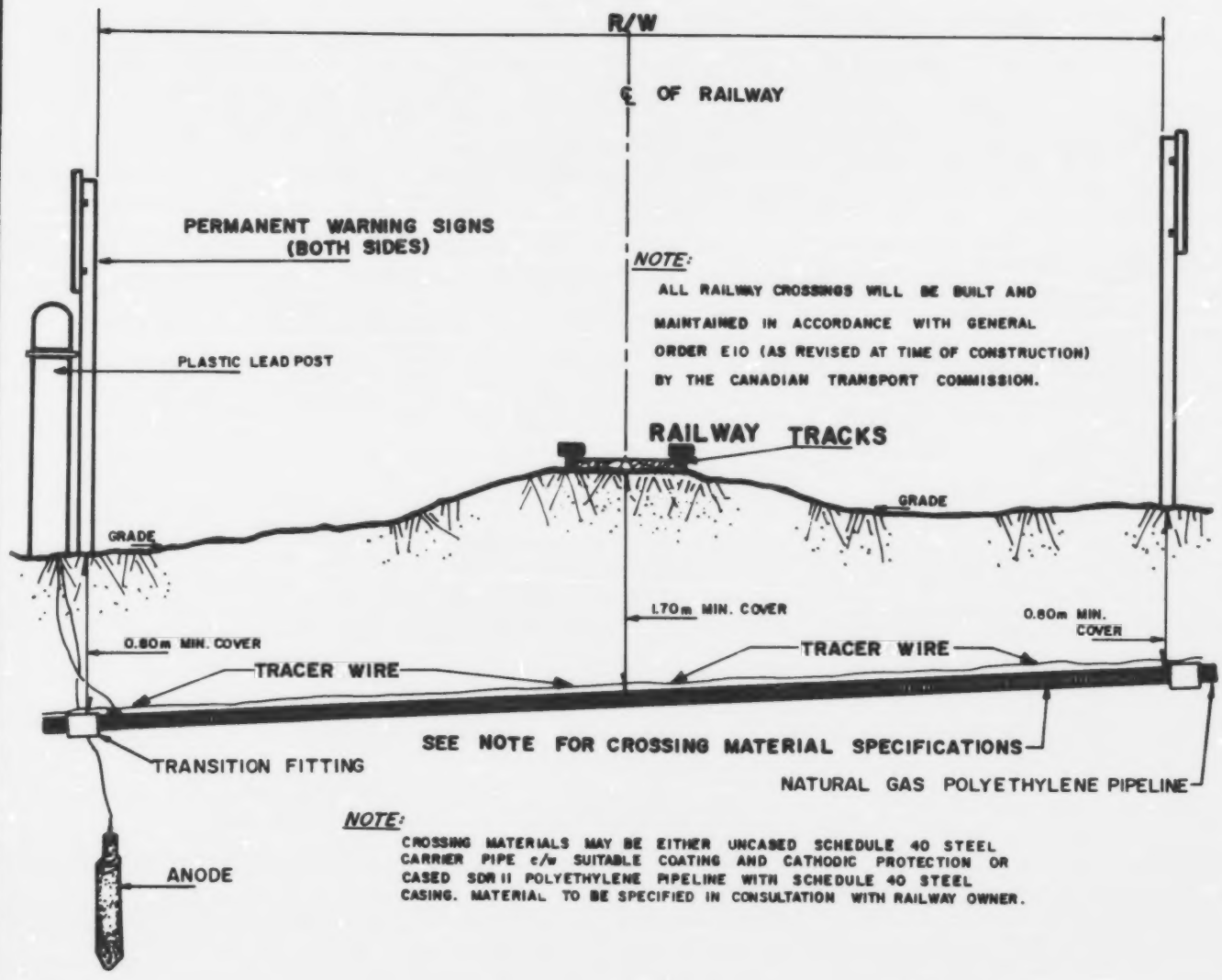
FIGURE 4.3

STANDARD DIMENSIONAL INFORMATION FOR HIGHWAY OR ROAD CROSSINGS

ROAD TYPE	ROAD AUTHORITY	NOMINAL RIGHT-OF-WAY WIDTH	MINIMUM DEPTH OF COVER	STANDARD LOCATION OF HORIZONTAL OR VERTICAL BENDS
Multi-Lane Primary Highways	Alberta Transportation and Utilities	100m	140cm	30m from edge of right-of-way
2-Lane Primary Highways	Alberta Transportation and Utilities	60m	140cm	30m from edge of right-of-way
900 Series Secondary Roads	Alberta Transportation and Utilities	60m	140cm	30m from edge of right-of-way
Other Secondary Roads or Park Roads	Local Municipal Authority or Alberta Transportation and Utilities	40m	110cm	20m from centre-line right-of-way
Local Municipal Roads, Service Roads or Subdivision Roads	Local Municipal Authority or Alberta Transportation and Utilities	30m	110cm	15m from centre-line right-of-way
Private Roads	As Applicable	Varies	110cm	at edge of right-of-way


R/W
℄ OF RAILWAY
PERMANENT WARNING SIGNS
(BOTH SIDES)
NOTE:
ALL RAILWAY CROSSINGS WILL BE BUILT AND MAINTAINED IN ACCORDANCE WITH GENERAL ORDER E10 (AS REVISED AT TIME OF CONSTRUCTION) BY THE CANADIAN TRANSPORT COMMISSION.
PLASTIC LEAD POST
RAILWAY TRACKS
GRADE
GRADE
1.70m MIN. COVER
0.80m MIN. COVER
0.80m MIN. COVER
TRACER WIRE
TRACER WIRE
SEE NOTE FOR CROSSING MATERIAL SPECIFICATIONS
TRANSITION FITTING
NATURAL GAS POLYETHYLENE PIPELINE
NOTE:
CROSSING MATERIALS MAY BE EITHER UNCASED SCHEDULE 40 STEEL CARRIER PIPE c/w SUITABLE COATING AND CATHODIC PROTECTION OR CASED SDR 11 POLYETHYLENE PIPELINE WITH SCHEDULE 40 STEEL CASING. MATERIAL TO BE SPECIFIED IN CONSULTATION WITH RAILWAY OWNER.
ANODE

TYPICAL RAILWAY CROSSING

FIGURE 4.4
N.T.S.

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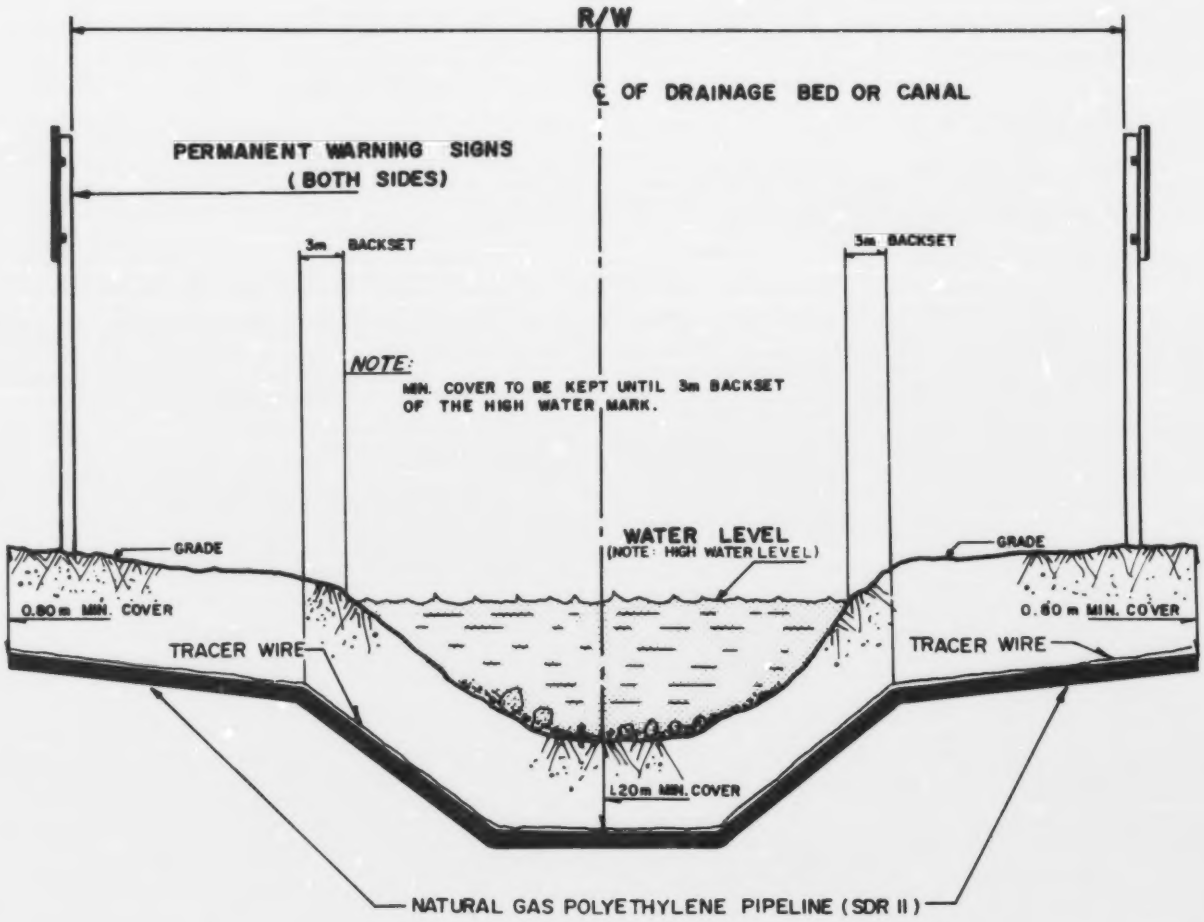

TYPICAL WATER/CANAL CROSSING

FIGURE 4.5
N.T.S.

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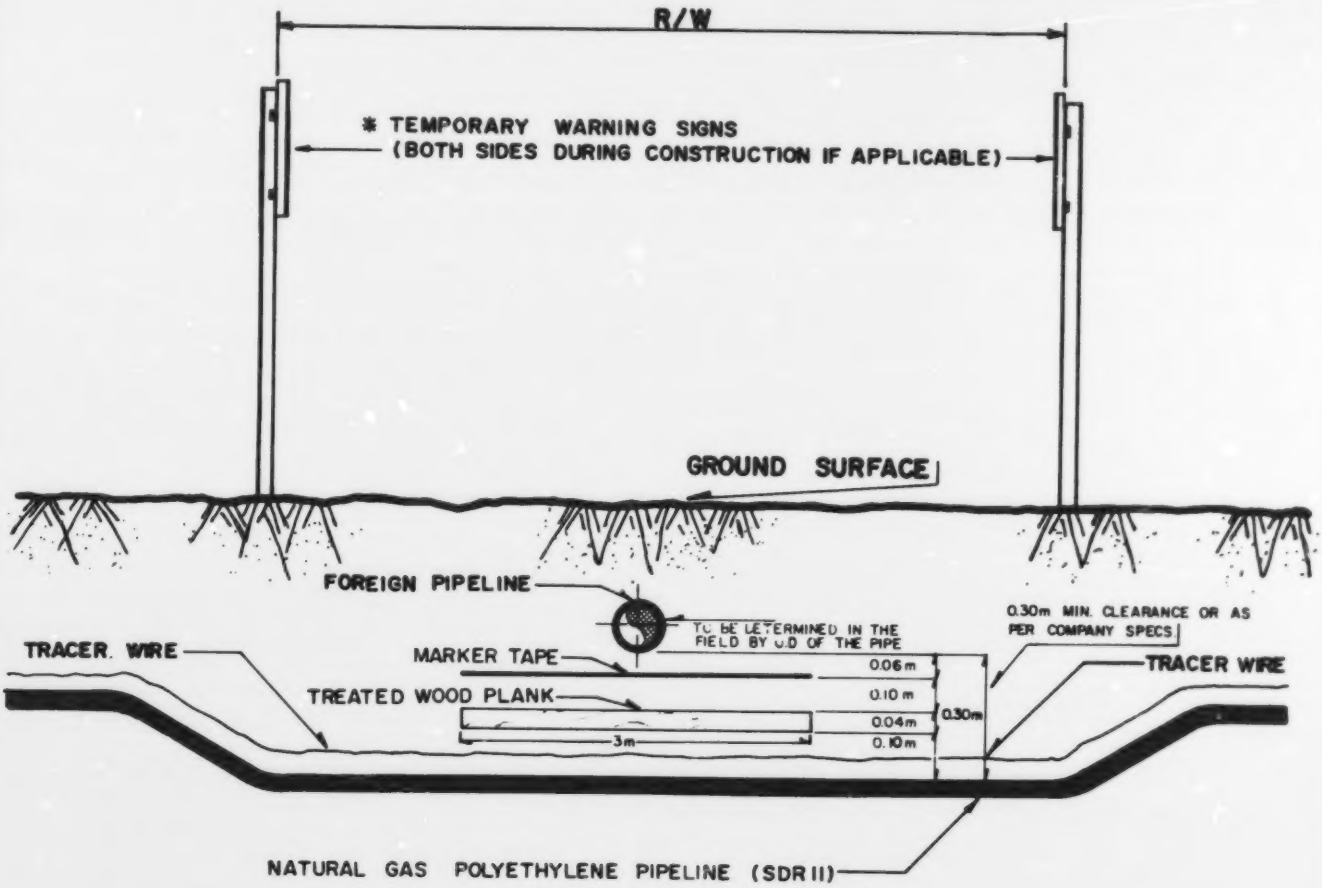

* *NOTE:*
INSTALLATION OF MARKER TAPE AND TREATED WOOD PLANK IS OPTIONAL, BUT MAY BE SPECIFIED BY FOREIGN PIPELINE OWNER.

TYPICAL PIPELINE CROSSING

FIGURE 4.6
N.T.S.

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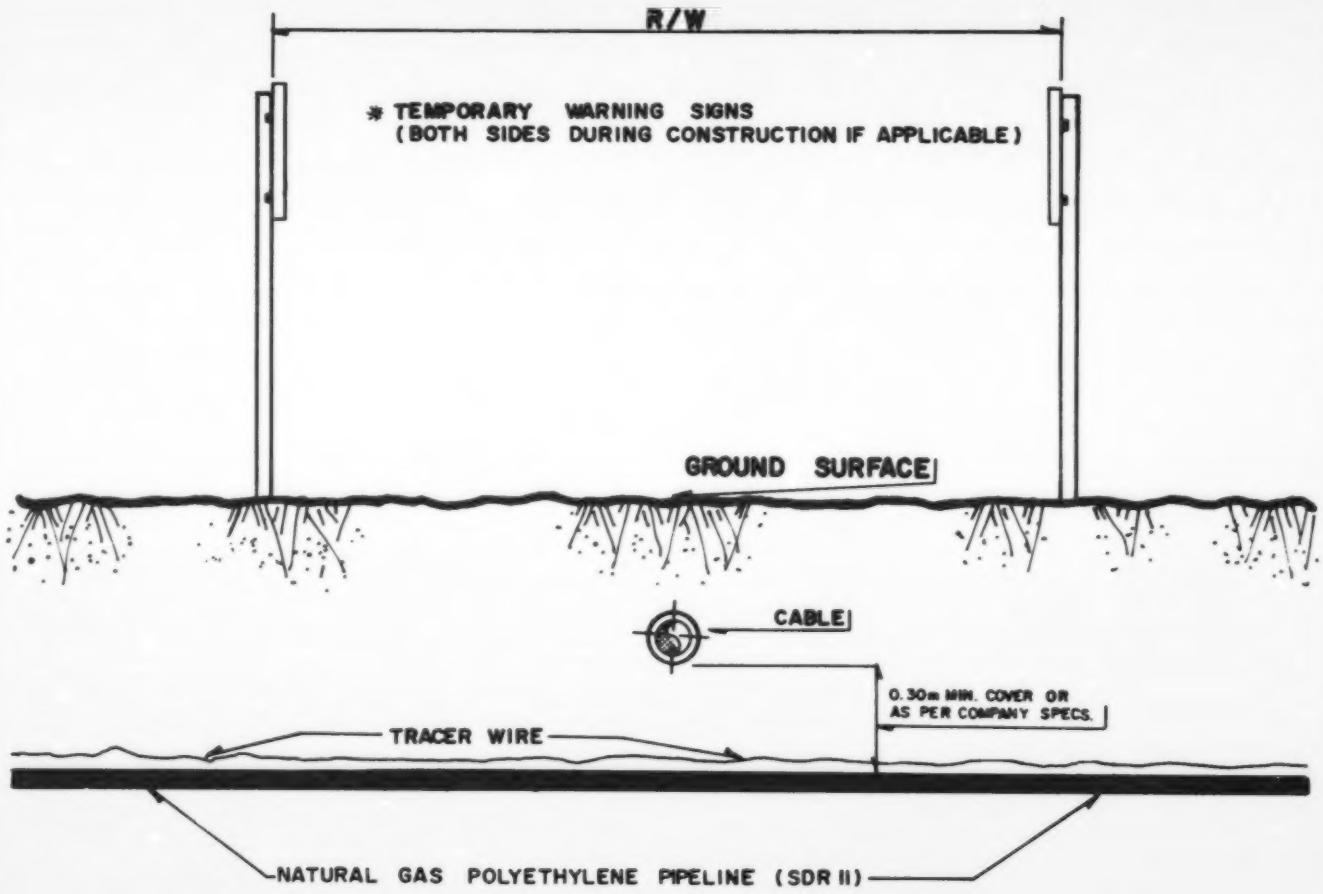

* *NOTE:* TEMPORARY WARNING SIGNS DURING CONSTRUCTION ARE OPTIONAL AND DEPEND ON LOCAL CONDITIONS AT TIME OF INSTALLATION.

TYPICAL CABLE CROSSING

FIGURE 4.7
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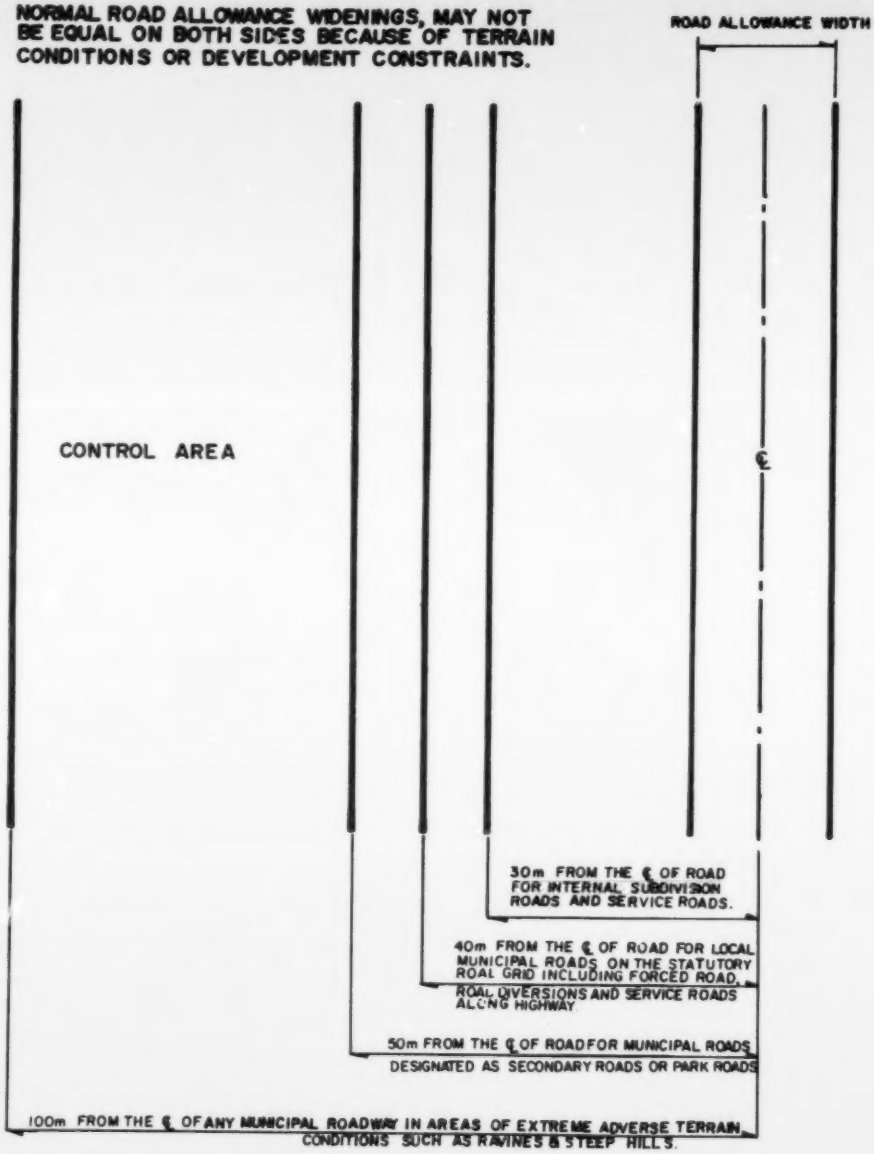
NOTE : NORMAL ROAD ALLOWANCE WIDENINGS, MAY NOT BE EQUAL ON BOTH SIDES BECAUSE OF TERRAIN CONDITIONS OR DEVELOPMENT CONSTRAINTS.


ROAD ALLOWANCE WIDTH
CONTROL AREA
℄
30m FROM THE ℄ OF ROAD FOR INTERNAL SUBDIVISION ROADS AND SERVICE ROADS.
40m FROM THE ℄ OF ROAD FOR LOCAL MUNICIPAL ROADS ON THE STATUTORY ROAD GRID INCLUDING FORCED ROAD, ROAD DIVERSIONS AND SERVICE ROADS ALONG HIGHWAY
50m FROM THE ℄ OF ROAD FOR MUNICIPAL ROADS DESIGNATED AS SECONDARY ROADS OR PARK ROADS
100m FROM THE ℄ OF ANY MUNICIPAL ROADWAY IN AREAS OF EXTREME ADVERSE TERRAIN CONDITIONS SUCH AS RAVINES & STEEP HILLS.

NOTE: CONTROL AREA IS ON EITHER SIDE OF ℄ OF ROADWAY

CONTROL AREA FOR PIPELINES PARALLEL TO LOCAL MUNICIPAL ROADS

FIGURE 4.8
N.T.S.

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5. Construction

5.1 General

Construction of distribution systems or pipelines which fall within the scope of this manual must not commence until the distributor is in receipt of any approvals, permits or rights-of-entry granted by regulatory authorities having jurisdiction, landowners, and the owners or administrators of any other lands or any facilities which are to be crossed. All construction must be carried out in accordance with approved designs and specifications and with recognized safety practices.

5.2 Material Specifications

All materials intended for installation within the scope of this manual must comply with the requirements of any regulatory authority having jurisdiction and with any applicable CSA Standard. Gas meters and ancillary instruments and controls must comply with the requirements of Consumer and Corporate Affairs Canada. In addition, only polyethylene pipe which has been released for installation under the Branch's Quality Assurance Program should be accepted for installation.

Materials should be selected in accordance with the following criteria:

(a) Safety of installation and operation;

(b) Efficiency of operation;

(c) Initial capital cost of construction;

(d) Operating and maintenance costs;

(e) Availability of spare and replacement parts during the anticipated operating life;

(f) The physical and chemical properties of the natural gas which is to be transmitted;

(g) Where applicable, the atmospheric conditions under which the materials will operate;

(h) The frequency, extent, and type of servicing which will be provided by the distributor.

Tracer wire manufactured from 16 gauge solid core copper wire with an extruded polyethylene coating should be installed simultaneously with polyethylene pipe. Above ground connectors for tracer wire should be specifically designed and manufactured to provide insulated electrical continuity for the tracer wire.

5.3 Materials Handling

Suitable techniques should be developed and utilized to prevent damage to materials during transportation, storage, and installation. During transportation, all materials should be loaded and secured to the vehicle in a suitable manner such that damage to materials is prevented. Line pipe in particular should be protected by:

(a) ensuring that the vehicle is free of protruding nails or other sharp objects which could damage the pipe;

(b) ensuring that the pipe is firmly secured and properly supported to prevent spillage from the vehicle.

Materials should be stored and handled in a suitable manner to prevent damage from mechanical handling equipment, other vehicles, and weather conditions. Line pipe should be stacked to a maximum height such that damage to bottom layers by crushing does not occur, and care should be taken to avoid exposing polyethylene pipe to direct sunlight for more than one or two years.

5.4 Project Management

Good project management techniques should be used to ensure that construction is carried out in an effective and efficient manner. Some of the responsibilities which a project manager is involved in include ensuring that:

(a) the planning, co-ordination, and implementation of a construction project is carried out in an efficient manner and in accordance with the requirements of any regulatory authority having jurisdiction;

(b) the necessary permits and approvals are obtained from any regulatory authority;

(c) any specific requirements of any permit or approval are complied with in all respects throughout the duration of the construction project;

(d) any specific requirements of any person or any agency which has provided a utility right-of-way are complied with in all respects;

(e) construction of the project is carried out in accordance with all applicable design plans, contract documents, and crossing agreements;

(f) any damage to land and property is minimized as far as is practical and all such damage is recorded fully and subsequently repaired to the reasonable satisfaction of the owner of that land or property and in accordance with any applicable surface rights or environmental legislation or regulations;

(g) suitable procedures are used for crossing of foreign pipelines and cables, and the specified requirements of the owners of foreign pipelines and cables are complied with in all respects;

(h) suitable quality assurance procedures are developed and implemented for the handling, storage, and installation of materials;

(i) construction procedures used for the project are in conformance with all applicable codes and standards, the specific requirements of any regulatory authority, and the correct technical interpretation of the specifications in any contract between the distributor and the person undertaking the construction project;

(j) suitable testing procedures are developed and utilized to qualify any person who will be engaged in welding of steel pipelines, high energy jointing of aluminum pipelines, and fusion of polyethylene pipelines;

(k) the person undertaking the construction project complies fully with all requirements of legislation and standards involved in the construction project;

(l) the location and depth of all distribution pipelines and plant, and the location of all above ground appurtenances, are accurately recorded;

(m) landowners are satisfied that rights-of-way have been cleaned-up and restored, and a release has been executed by the landowner before the contractor is relieved of his responsibilities in this regard.

5.5 Right-of-Entry and Crossing

Before any construction takes place, the approval of an owner or administrator whose land, property or facility is to be crossed must be obtained. The right to enter or to cross must be in written form such as:

(a) a utility right-of-way or similar instrument which can be registered against the appropriate land title (e.g. used for right-of-entry to private lands);

(b) a legal agreement (e.g. used for crossings of roads, foreign pipelines, etc.); or

(c) written authorization by a person who is empowered to exercise that authority (e.g. used for crossing of watercourses, right-of-entry to Crown lands, etc.).

5.6 Pipeline Jointing

5.6.1 Welding of Steel or Aluminum Pipelines

Welding of joints in steel or aluminum pipelines must comply with the requirements of any applicable CSA Standards and of the Energy Resources Conservation Board.

5.6.2 Fusion of Polyethylene Pipe

A person who intends to carry out fusion of polyethylene pipes must be trained and certified by an agency approved by the Branch and must produce a current and valid certificate (ticket) upon request by a Branch representative.

An agency may be approved to provide training and certification by demonstrating that it has the equipment, facilities, suitable trainer(s) and programs for certifying and re-certifying candidates.

In order to obtain certification, a candidate must demonstrate by examination:

(a) a good knowledge of polyethylene pipe installation and safety practices;

(b) the ability to discriminate between poor and acceptable fusions;

(c) the proficiency to consistently make socket, butt and saddle fusions using conventional equipment.

Certification is valid for one year from date of receipt and may be continued by completion of an annual refresher course from any of the approved agencies.

Only those materials, fittings, equipment and methods that are permitted in applicable CSA Standards and recommended by the manufacturer of the pipe material which is to be joined should be used in polyethylene pipe fusions. Particular care should be taken when fusing two dissimilar materials.

The pocketbook-size "Polyethylene Fusion Guide for Gas Distribution Pipe" co-sponsored by the Branch and a number of training agencies is recommended for the use and reference of all persons who intend to carry out polyethylene pipe fusions.

The fusion method should be used for polyethylene pipe jointing whenever possible. Compression fittings may be used when fusion is impractical provided that split inserts are not used and the fitting selected has been proven by test to be capable of withstanding the longitudinal pull-out forces to which the pipe may be subjected.

5.7 Pipeline Installations

Distribution pipelines should be installed in accordance with good engineering practice and in accordance with the CAN/CSA-Z184 Standard, latest edition. Care should be taken to avoid excessive stresses (e.g. polyethylene pipe should be "snaked" during installation to allow for contraction at low temperatures).

Polyethylene pipe should not be uncoiled and plowed-in where the pipe temperature is less than $-7°C$ or as otherwise recommended by the pipe manufacturer. In addition, the minimum radius of pipe curvature caused by the plow chute shall not be less than the minimum recommended by the pipe manufacturer.

Where pipe is to be installed in sub-surface conditions where rock is present, special care must be taken to encase the pipe in a protective material such as sand (see Figure 5.1).

5.8 Surface Installations

Temporary pipeline installations may be made on the surface of the ground provided that adequate precautions are taken to prevent damage to the pipeline and to ensure the safety of the public. Surface installations

of high pressure steel or aluminum pipelines require the prior approval of the Energy Resources Conservation Board.

Temporary surface installations of polyethylene pipe may be made on approval by the Branch provided that the pipeline owner can demonstrate that the installation will be protected from damage during the period in service. Warning signs should be installed at specific distances to clearly identify the existence of the pipeline, and other precautions may also be requested by the Branch.

5.9 **Warning Signs**

Where a pipeline is buried below a highway, road, railway, canal or watercourse, a suitable warning sign should be permanently installed outside but within 30 centimetres of the edge of each side of the right-of-way following construction to identify the existence of the buried pipeline. Temporary warning signs should be used during construction while crossing facilities such as foreign pipelines or other utilities where permanent signs are impractical.

The design of the warning sign and the material used should meet the intent of the CAN/CSA-Z184 Standard, latest edition, and may be subject to approval by the Branch. Warning signs for high pressure pipelines must meet the requirements of the Energy Resources Conservation Board.

Warning signs should be installed within 60 days of completion of construction or within a lesser period if clear evidence of construction no longer exists. Signs should be installed directly above the pipeline at a height and position that will ensure that the sign is clearly visible at all times. Where appropriate, consideration should be given to making provision for determining the depth of cover over a pipeline adjacent to a warning sign. (See Figure 5.2.)

5.10 **Domestic Meter Installations**

Domestic meter installations should be installed in a manner that will avoid excessive stress on the meter, piping and ancillary equipment. The location of domestic meter sets should, if possible, be outside buildings and care should be taken to ensure that vented gas from relief valves can escape freely to the atmosphere and not be drawn inside the building through vents. (See Figure 5.3.)

For the two different types of riser the minimum horizontal distance between the meter set to the transition fitting should be 1.2 metres (4 feet) for the anodeless type and 4.6 metres (20 feet) for a steel riser with anode.

A typical domestic meter set is illustrated in figure 5.4 while a typical riser assembly upstream of the meter set is shown in 5.5.

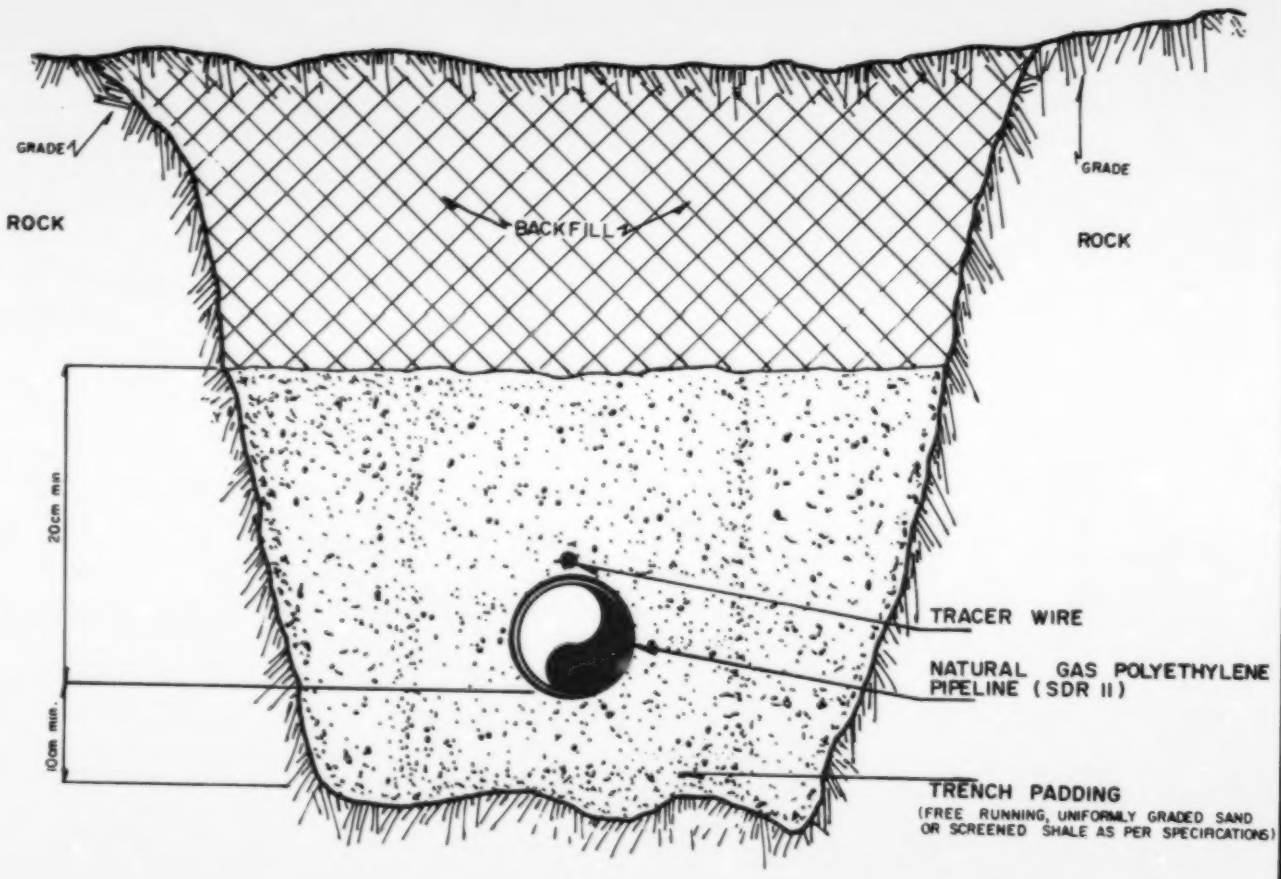
5.11 **Cathodic Protection**

Pipelines, plant, and appurtenances that are subject to accelerated corrosion due to electrochemical conditions must be adequately protected from such corrosion and should be designed and installed by a person knowledgeable in that field of expertise.

Metallic pipelines must be cleaned and coated with a suitable protective coating which is specifically manufactured for that purpose and bonded to the pipeline by recognized methods. Where connection of dissimilar materials occurs in a pipeline system, or where it is necessary to electrically isolate individual sections of a pipeline and the cathodic protection system, the connections or isolation points must be made with suitable insulation fittings or flanges specifically designed and manufactured for that purpose.

Installation of a cathodic protection system should be simultaneous with the installation of the pipeline system to be protected, except in circumstances where it is necessary or advisable to allow adequate settlement of trench backfill prior to the measurement of pipe-to-soil electrical potential.

A typical cathodic protection test station and anode installation is illustrated in Figure 5.6.



COMPACTED BEDDING AND BACKFILL MATERIAL
AS PER SPECIFICATIONS

TYPICAL CROSS-SECTION FOR SAND PADDED ROCK DITCH

FIGURE 5.1
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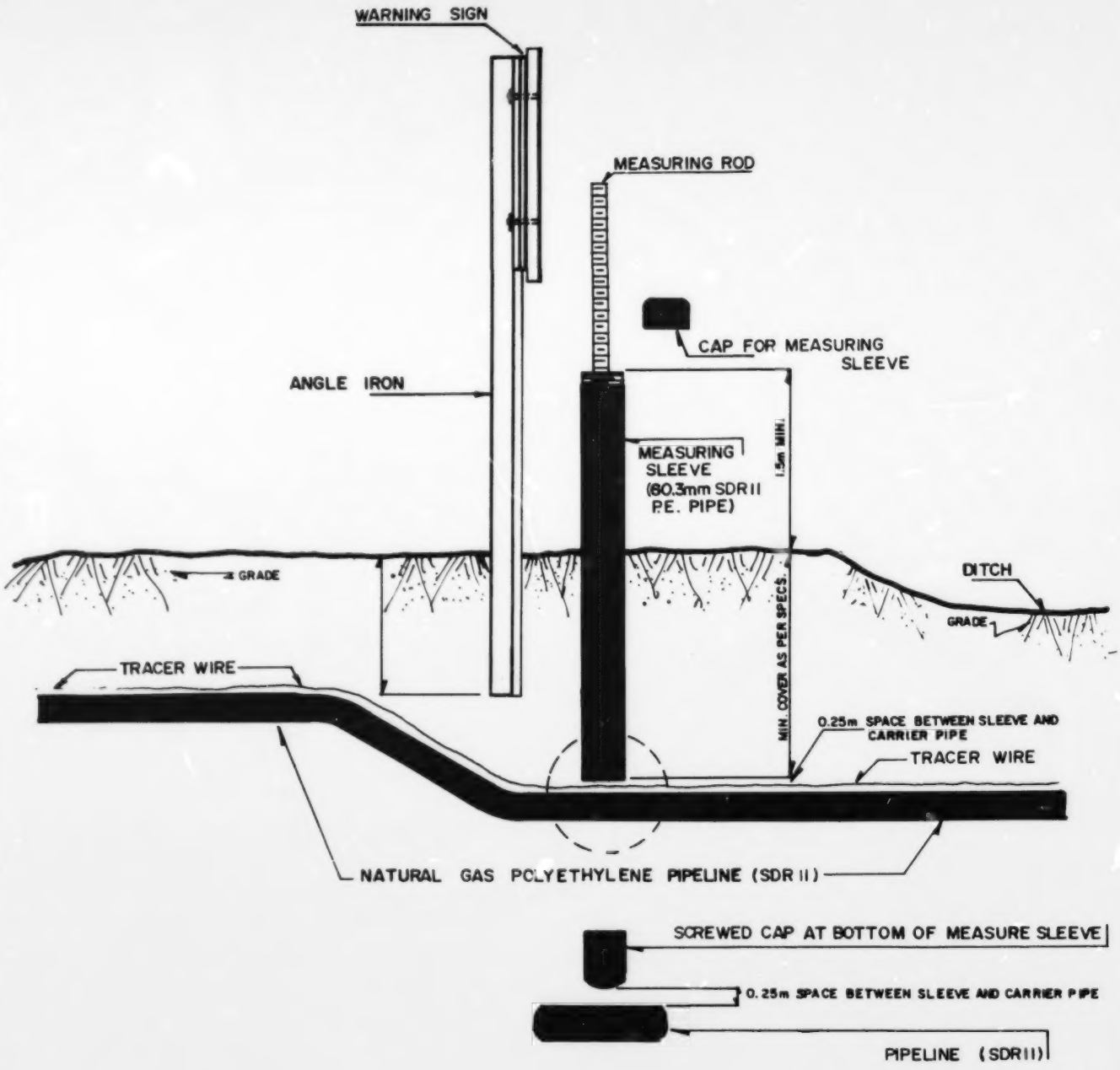

DETERMINING DEPTH OF COVER AT CROSSING LOCATION

FIGURE 5.2
N.T.S.

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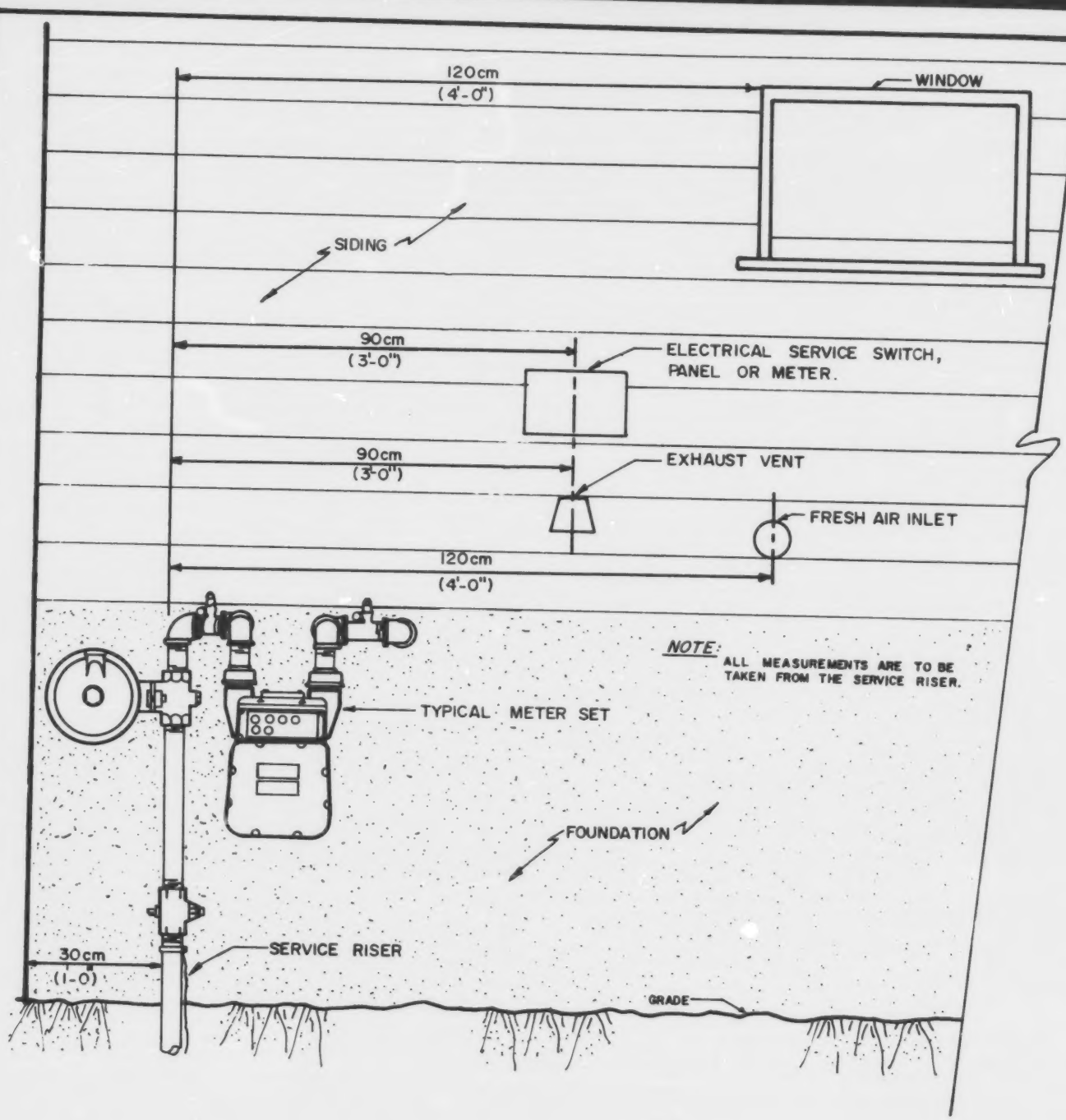

LOCATION OF METER/RISER SETS TO BUILDING OPENINGS

FIGURE 5.3
N.T.S.

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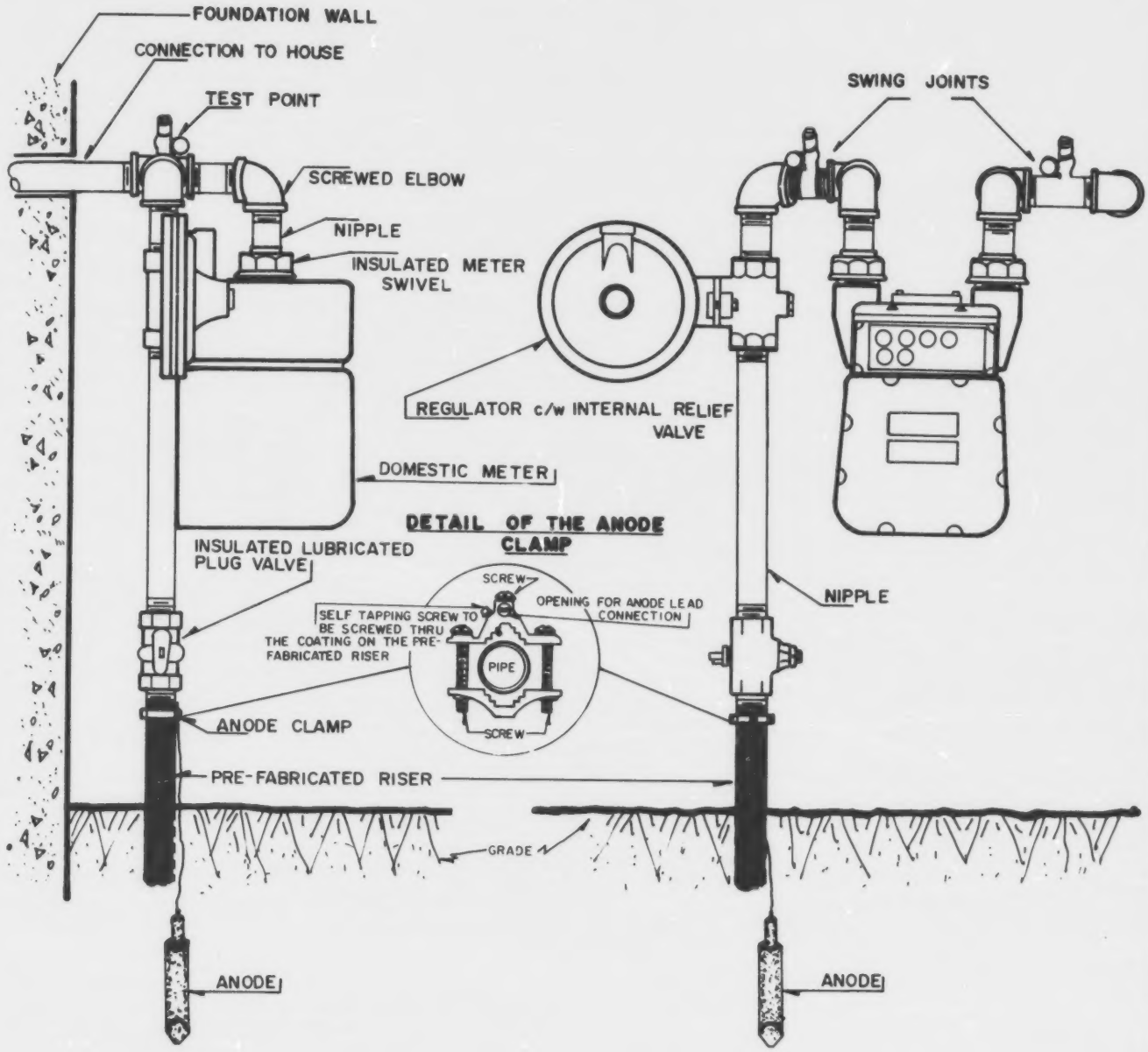

TYPICAL DOMESTIC METER SET

FIGURE 5.4
N.T.S.

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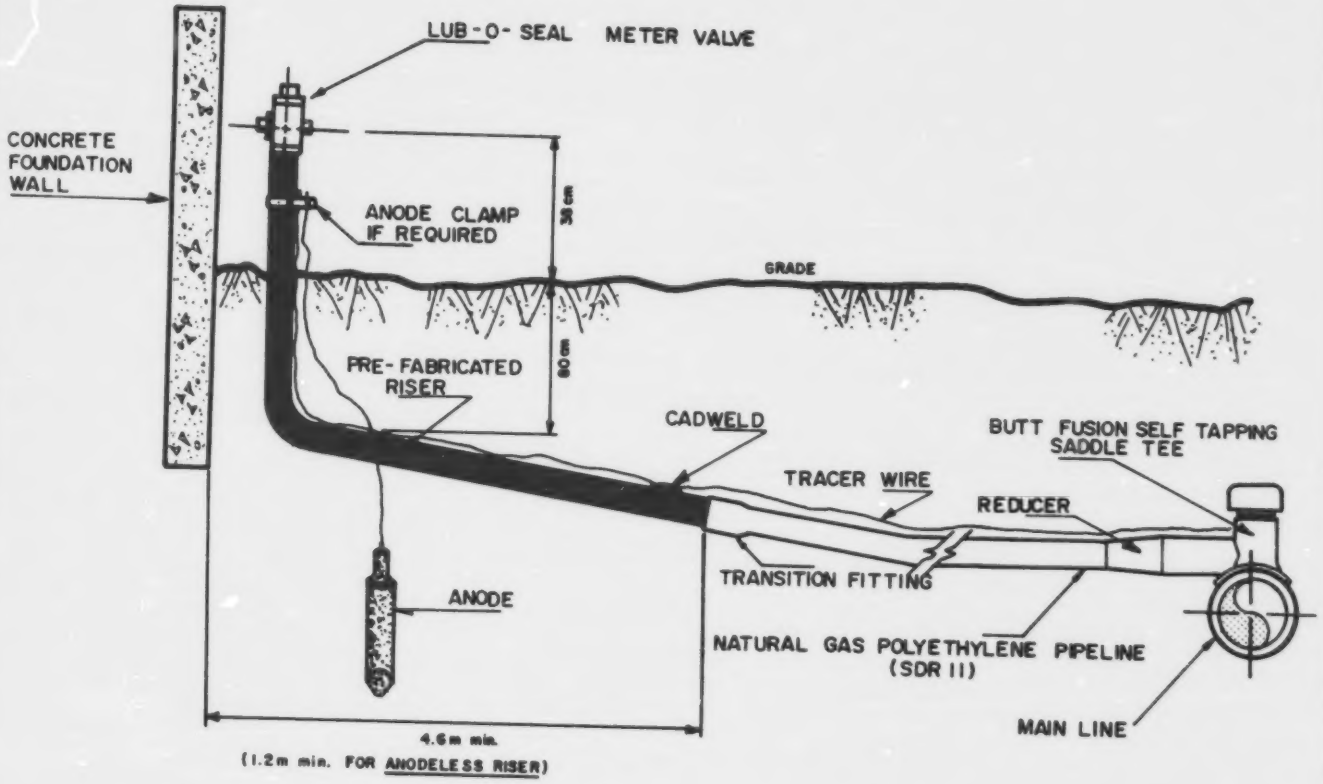

ALL FITTINGS TO BE C.S.A. APPROVED

NOTE:
ANODELESS RISER ASSEMBLIES MAY ALSO BE USED

TYPICAL RISER DETAIL

FIGURE 5.5
N.T.S.

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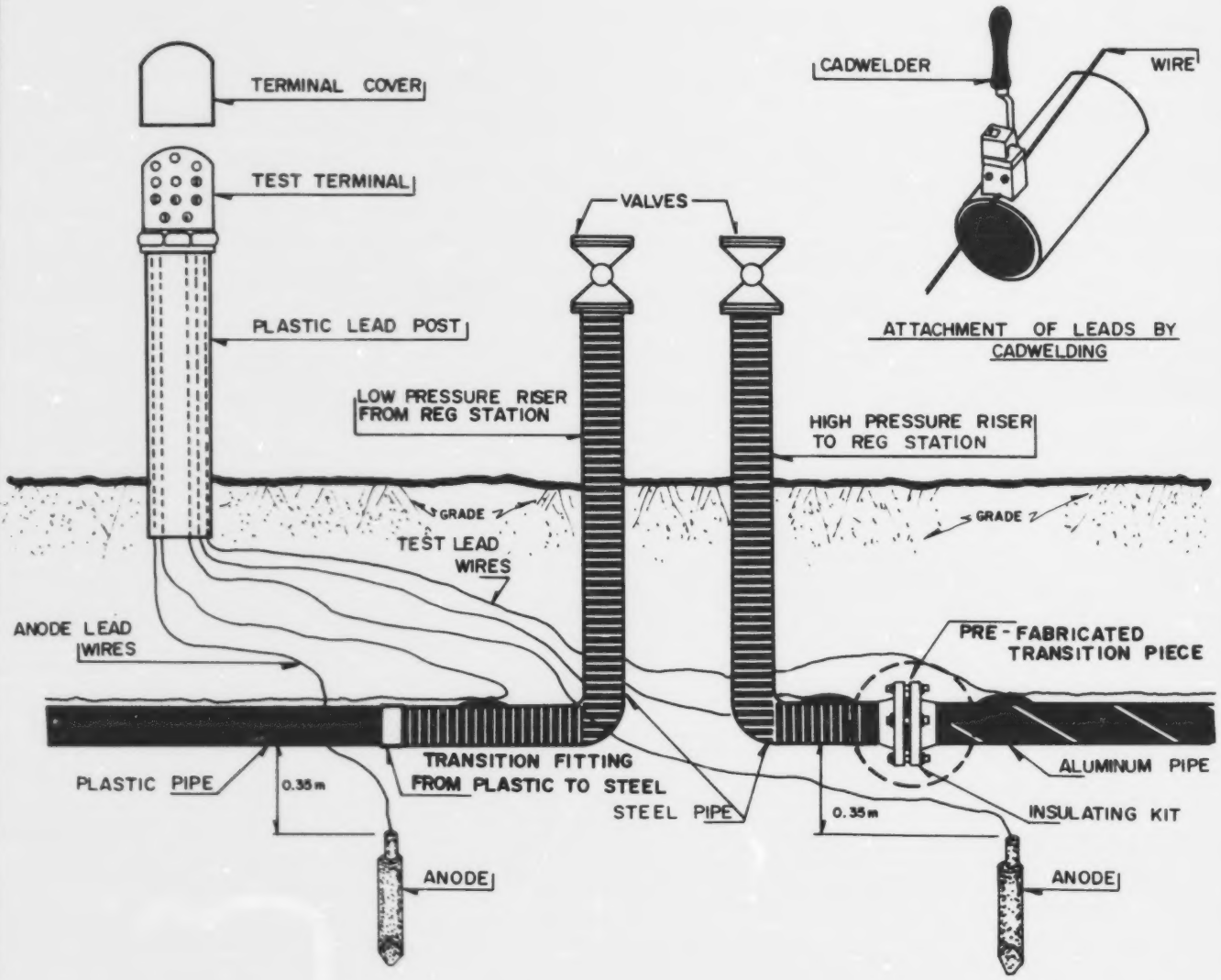

NOTE:
CADWELDING SHOULD NOT BE CARRIED OUT WHEN PIPELINE IS PRESSURIZED.

TYPICAL TEST STATION c/w ANODE INSTALLATION

FIGURE 5.6
N.T.S.

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6. Regulator Stations and Isolation Valve Assemblies

6.1 General

The number, type and location of regulator stations and isolation valve assemblies in a distribution system should be subject to very careful design considerations since these facilities are critical to the successful operation of the system. The location of these facilities is of principal concern since regulator stations and isolation valve assemblies should be adjacent to suitable access for year-round maintenance and operation, and should be on a high point of the pipeline and the terrain through which the pipeline is to be installed.

Each facility should be provided with:

(a) adequate structural support to prevent excessive stress on station and inlet/outlet piping;

(b) where applicable, a protective railing or fence to prevent damage from farm machinery;

(c) security measures to prevent unauthorized operation of valves and other equipment;

(d) where appropriate, a suitable protective housing to prevent malfunction of control devices due to inclement weather conditions and to prevent accelerated corrosion of such devices.

6.2 Regulator Stations

A wide variety of design and equipment options exist for regulator stations to suit the specific requirements of the downstream system which is being served. In selecting from these options, the designer should attempt to carefully balance the layout and equipment needed to facilitate good operational features against the capital costs of the station. For example, a "double-run, double-cut" pressure regulator design layout to service a system with only 20 domestic services would certainly provide good operational features but it would be rather extravagant for this simple application.

Pressure regulator stations should include sufficient ancillary fittings to provide for pressure gauges, swing joints, relief valves and accounting meters (See figure 6.1). "Pop" type relief valves should not be used.

Selection of the number and type of pressure regulators should take into account manufacturers' recommendations and specifications for pressure and volume flow, as well as the number and type of consumers in the downstream system and the pressure and volume flow requirements for that system. Recommended layouts and components for the four basic design options are illustrated in the following figures:

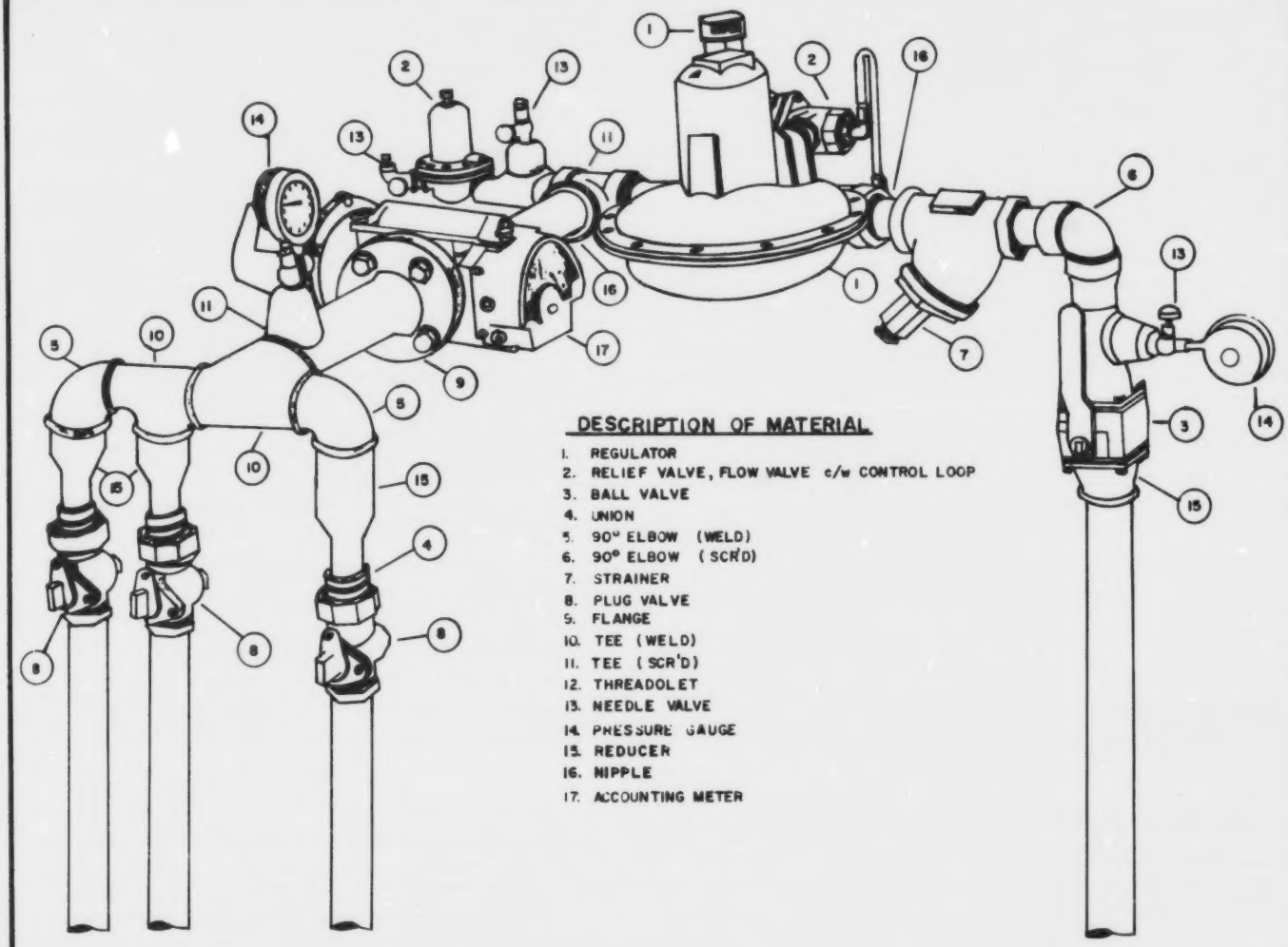
Figure 6.2 — single run, single cut design;
Figure 6.3 — single run, double cut design;
Figure 6.4 — double run, single cut design;
Figure 6.5 — double run, double cut design.

It is recommended that provision be made for accounting meters in all designs.

6.3 Isolation Valve Assemblies

Isolation valves should be strategically located to permit damaged or ruptured segments of distribution pipeline to be isolated for repair without the need to shut down the entire distribution system. The designer must exercise considerable judgement in selecting the best locations on the system for this purpose, taking into account the type of pipeline, the number and type of consumers who would be isolated from the supply, the line pack capability of the downstream system, and the terrain conditions. In the case of polyethylene systems, greater flexibility exists in system isolation through the use of squeeze-off tolls since the isolated segment can be more restricted. However, the type of polyethylene material used may not have sufficient properties to withstand the stresses imposed by the squeeze-off procedure and the use of isolation valves may be preferable in these cases.

Typical design layouts for both underground and above-ground assemblies are illustrated in figures 6.6 to 6.8 inclusive.



DESCRIPTION OF MATERIAL

1. REGULATOR
2. RELIEF VALVE, FLOW VALVE c/w CONTROL LOOP
3. BALL VALVE
4. UNION
5. 90° ELBOW (WELD)
6. 90° ELBOW (SCR'D)
7. STRAINER
8. PLUG VALVE
9. FLANGE
10. TEE (WELD)
11. TEE (SCR'D)
12. THREADOLET
13. NEEDLE VALVE
14. PRESSURE GAUGE
15. REDUCER
16. NIPPLE
17. ACCOUNTING METER

TYPICAL REGULATING STATION c/w ACCOUNTING METER

FIGURE 6.1
N.T.S.

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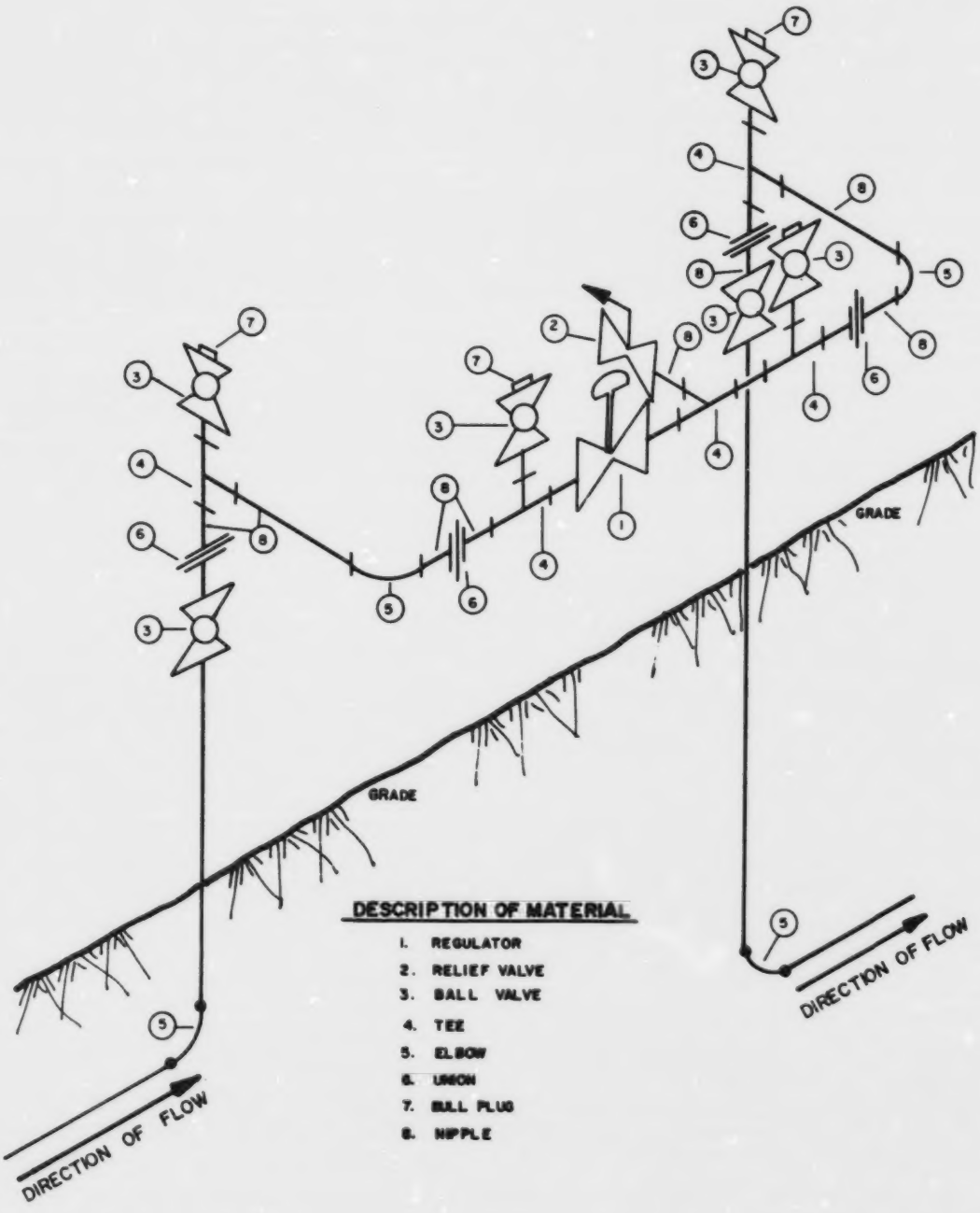

TYPICAL SINGLE-RUN, SINGLE-CUT REGULATOR STATION

FIGURE 6.2
N.T.S.

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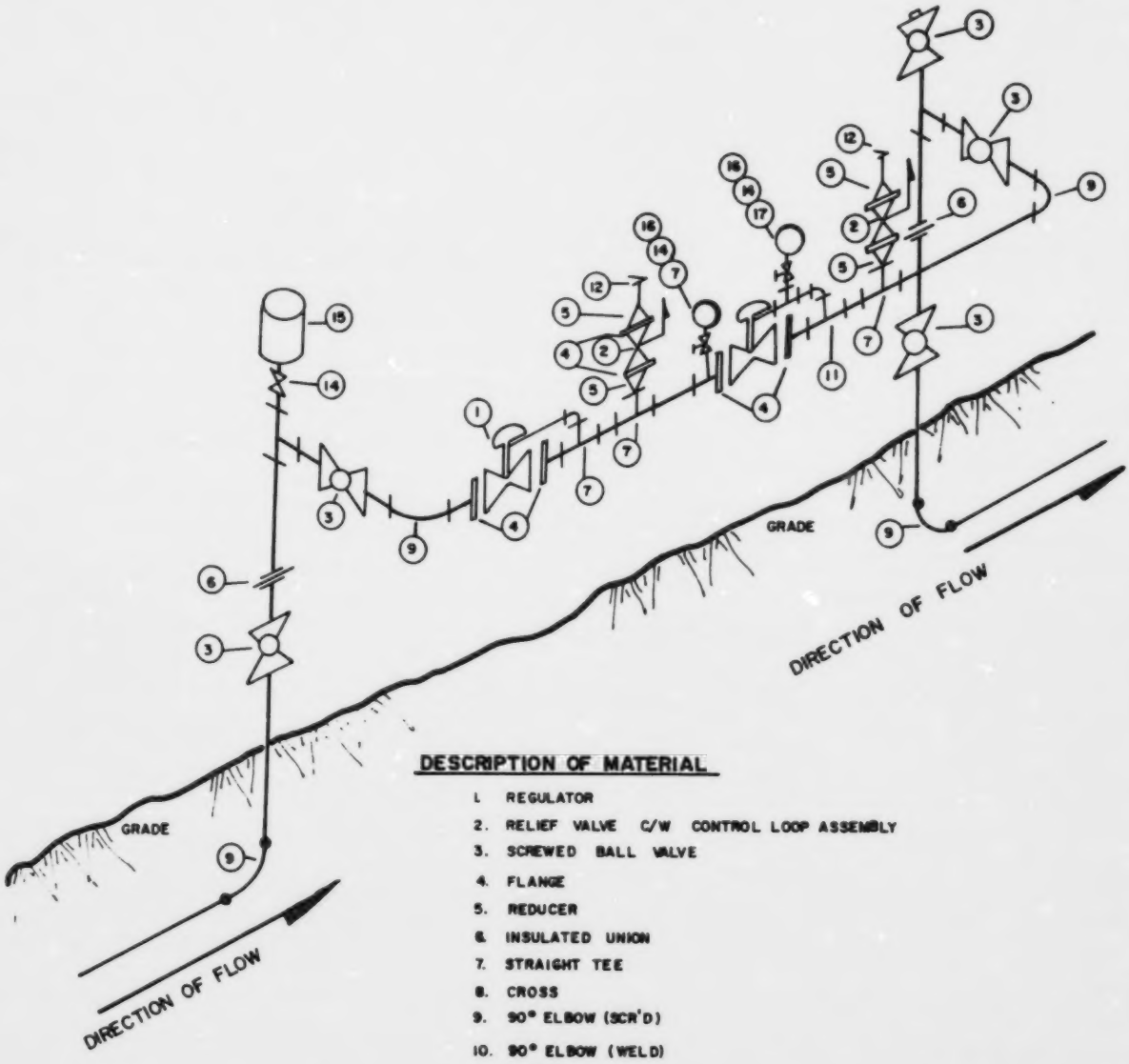

DESCRIPTION OF MATERIAL

1. REGULATOR
2. RELIEF VALVE C/W CONTROL LOOP ASSEMBLY
3. SCREWED BALL VALVE
4. FLANGE
5. REDUCER
6. INSULATED UNION
7. STRAIGHT TEE
8. CROSS
9. 90° ELBOW (SCR'D)
10. 90° ELBOW (WELD)
11. ELBOW
12. RAIN CAP
13. LUBRICATED PLUG VALVE
14. NEEDLE VALVE
15. ALCOHOL DRIP POT (OPTIONAL)
16. PRESSURE GAUGE
17. THREADOLET

TYPICAL SINGLE-RUN, DOUBLE-CUT REGULATOR STATION

FIGURE 6.3
N.T.S.

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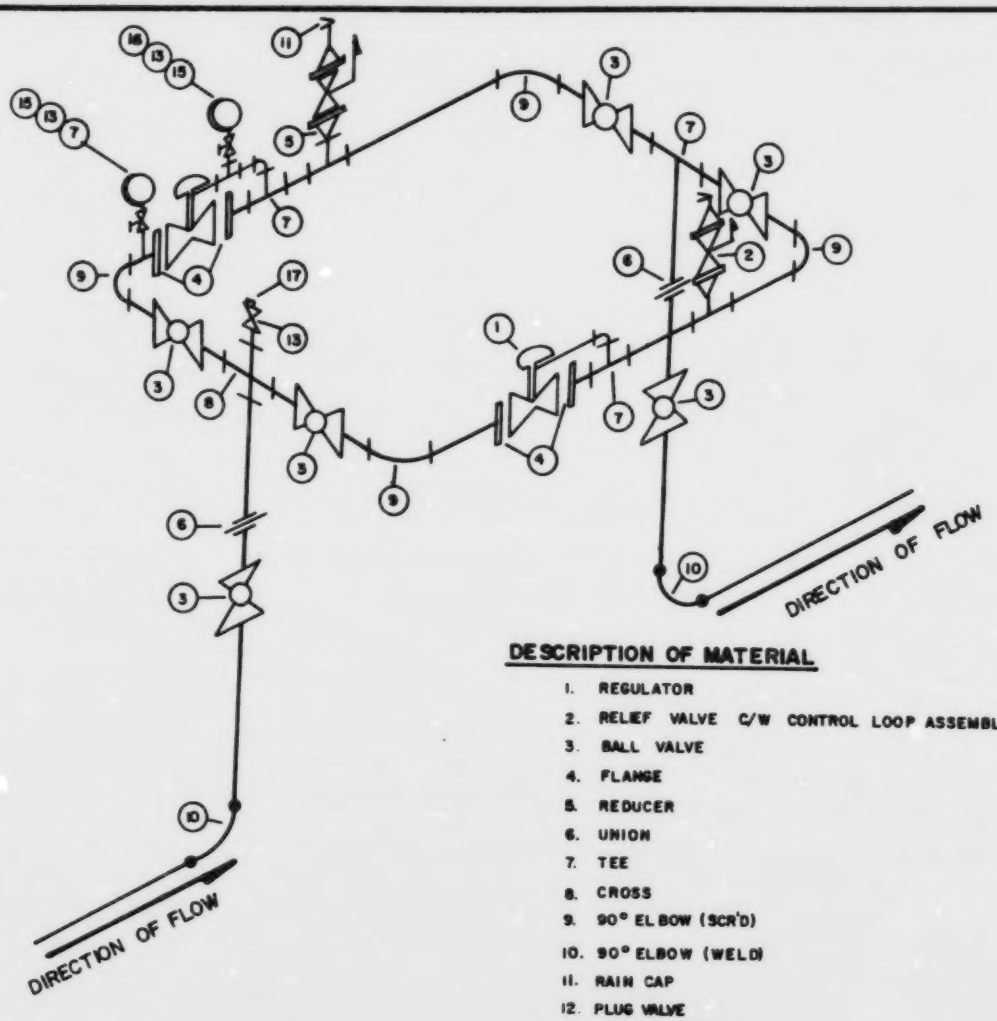
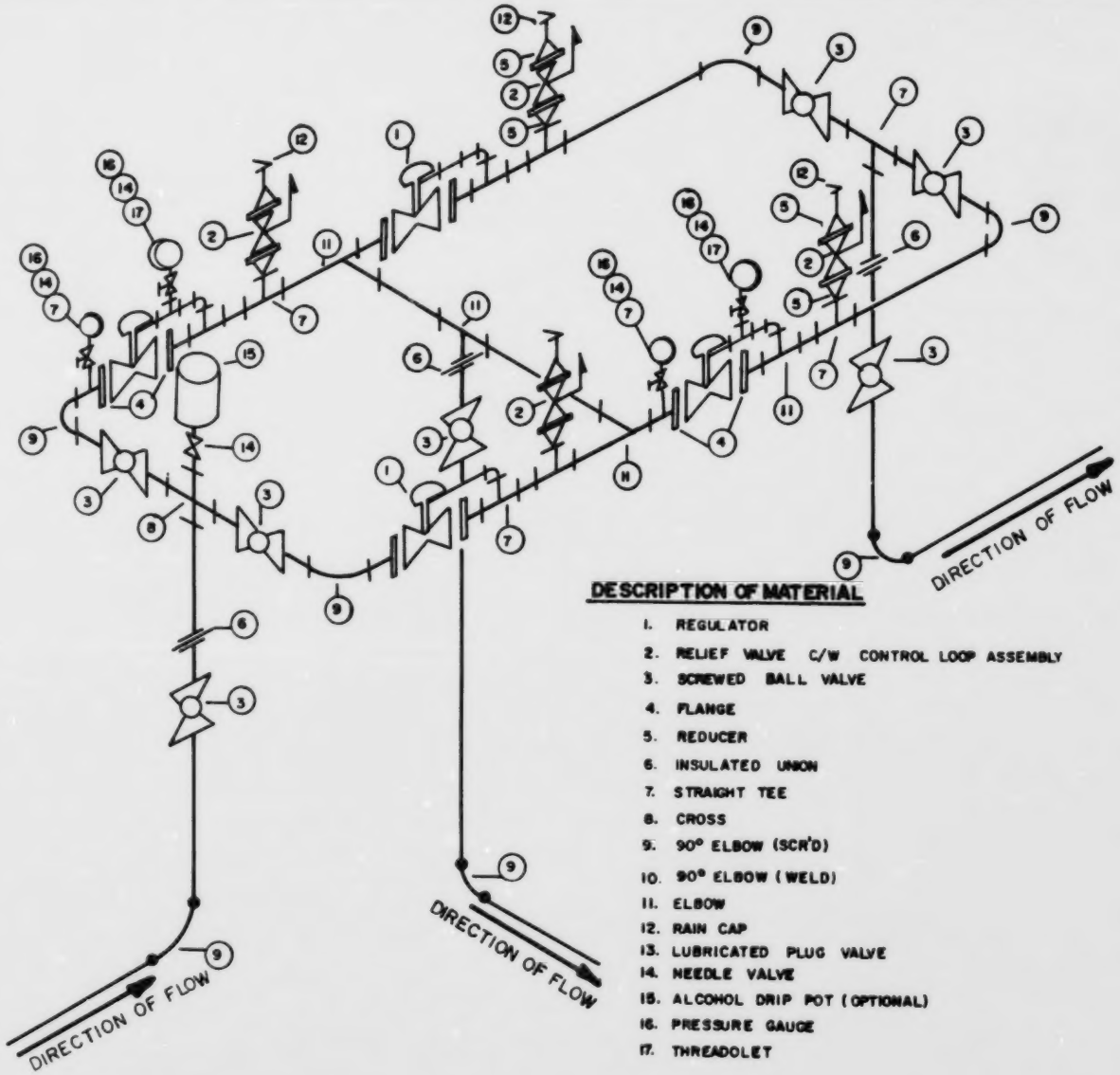


DESCRIPTION OF MATERIAL

1. REGULATOR
2. RELIEF VALVE C/W CONTROL LOOP ASSEMBLY
3. BALL VALVE
4. FLANGE
5. REDUCER
6. UNION
7. TEE
8. CROSS
9. 90° ELBOW (SCR'D)
10. 90° ELBOW (WELD)
11. RAIN CAP
12. PLUG VALVE
13. NEEDLE VALVE
14. ALCOHOL DRIP POT (OPTIONAL)
15. PRESSURE GAUGE
16. THREADOLET
17. BULL PLUG

TYPICAL DOUBLE-RUN, SINGLE-CUT REGULATOR STATION

FIGURE 6.4
N.T.S.



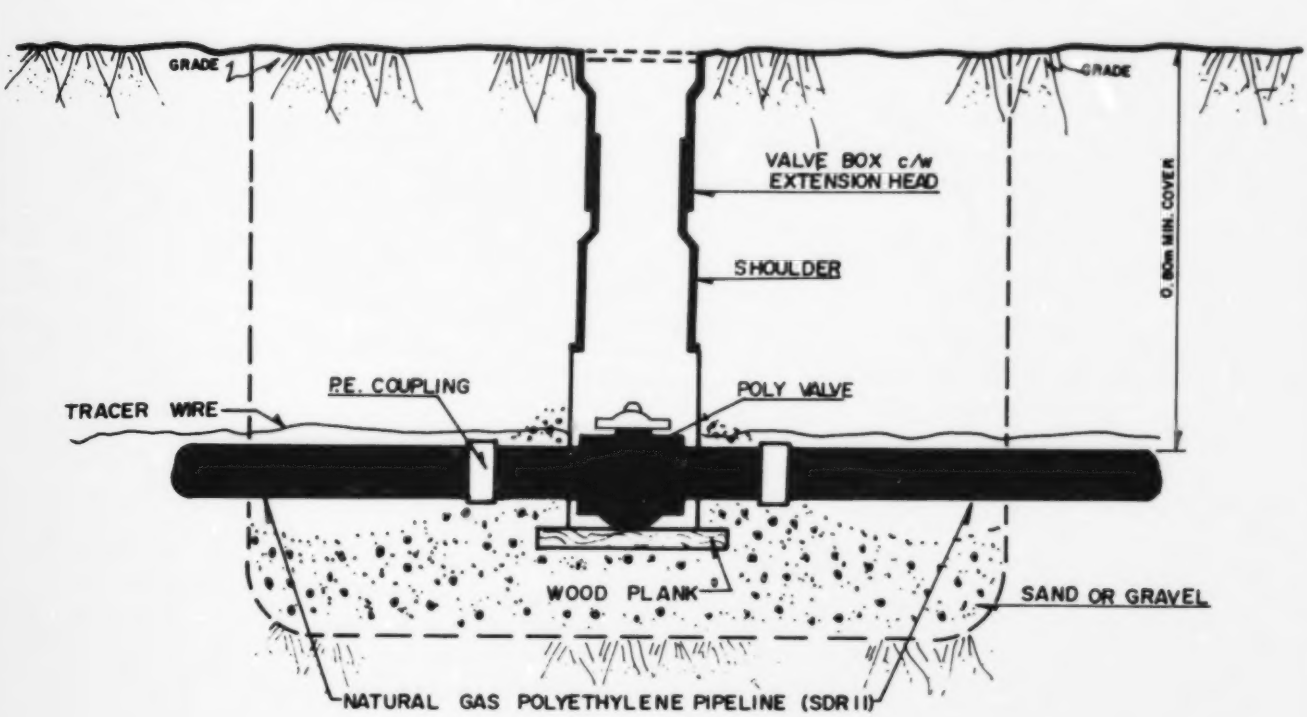
DESCRIPTION OF MATERIAL

1. REGULATOR
2. RELIEF VALVE C/W CONTROL LOOP ASSEMBLY
3. SCREWED BALL VALVE
4. FLANGE
5. REDUCER
6. INSULATED UNION
7. STRAIGHT TEE
8. CROSS
9. 90° ELBOW (SCR'D)
10. 90° ELBOW (WELD)
11. ELBOW
12. RAIN CAP
13. LUBRICATED PLUG VALVE
14. NEEDLE VALVE
15. ALCOHOL DRIP POT (OPTIONAL)
16. PRESSURE GAUGE
17. THREADOLET

TYPICAL DOUBLE-RUN, DOUBLE-CUT REGULATOR STATION

FIGURE 6.5
N.T.S.

TRANSPORTATION AND UTILITIES



TYPICAL UNDERGROUND ISOLATION VALVE ASSEMBLY 'POLYETHYLENE'

FIGURE 6.6
N.T.S.

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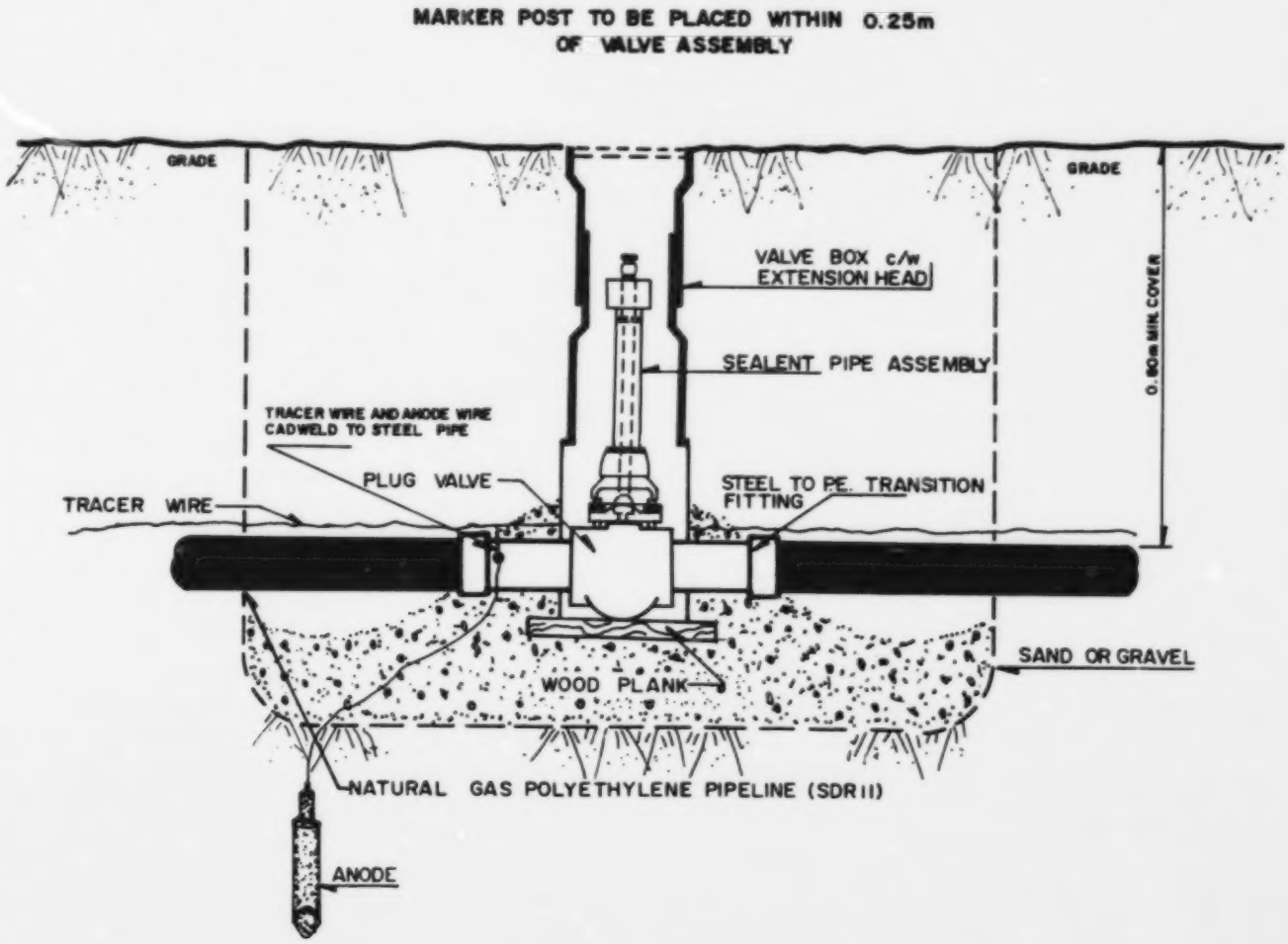

TYPICAL UNDERGROUND ISOLATION VALVE ASSEMBLY- STEEL

FIGURE 6.7
N.T.S.

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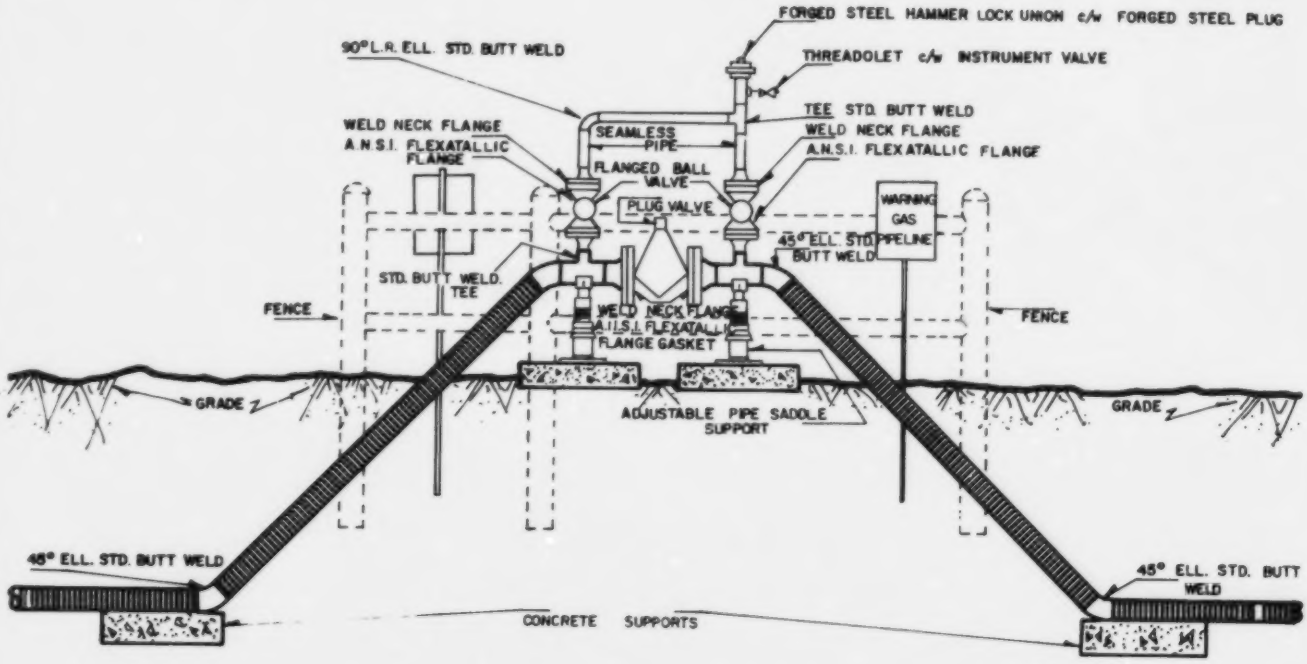

TYPICAL ABOVE GROUND ISOLATION VALVE ASSEMBLY - 'H.P STEEL'

FIGURE 6.8
N.T.S.

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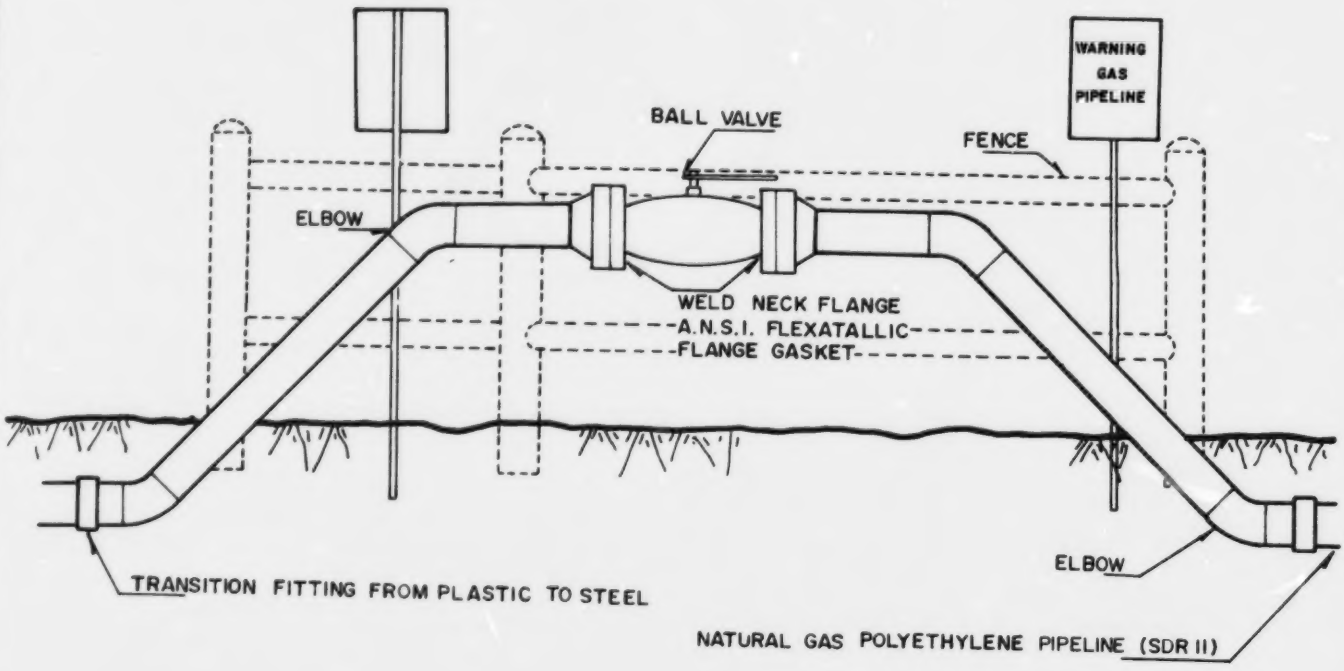

TYPICAL ABOVE GROUND ISOLATION VALVE ASSEMBLY - 'POLYETHYLENE'

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FIGURE 6.9
N.T.S.

7. Testing and Licensing of Pipelines

7.1 General

This section covers pressure testing and licensing of low pressure pipelines. Such pipelines will usually be manufactured from plastic materials. For high pressure pipelines, pressure testing and licensing requirements are prescribed and administered by the Energy Resources Conservation Board.

7.2 Maximum Operating Pressures

The Maximum Operating Pressure (M.O.P.) at which a distribution pipeline may operate is derived from a number of factors including material properties, the hoop stress at which the pipe may operate and the use of safety factors.

With respect to new pipeline systems, polyethylene materials currently used in Canada to produce gas pipe are all rated to a maximum "hydrostatic design basis" of 8.62 megapascals (MPa) at 23°C. Accordingly, the design formula for polyethylene pipe from the CAN/CSA-Z184 Standard will derive an M.O.P. of 552 kilopascals (kPa) for pipe with a "standard dimension ratio" (SDR) of 11. Note that SDR 11 pipe should be used for all polyethylene pipe systems under the scope of this manual unless special design factors must be considered.

For existing plastic piping systems, the M.O.P. will be specified in a license issued in accordance with section 7.4.

7.3 Pressure Testing

Pressure testing of new polyethylene systems should be based on a pressure which is 1.4 times the design M.O.P. and should be in accordance with the requirements of the CAN/CSA-Z184 Standard. For example, the recommended test pressure for SDR 11 pipe is 772 kilopascals (112 psi) for all installations even if it is intended to license and operate the pipeline system at less than the maximum pressure permitted by CAN/CSA-Z184.

The duration of a pressure test should be based on the length of the pipeline which is under test following a 20-minute cooling period after pressurizing, and should be not less than the following:

Length of Pipeline Under Test	Minimum Test Duration	Type of Pressure Recording Device
Less than 100m	15 minutes	Pressure Gauge
100m - 300m	4 hours	Chart Recorder
300m - 5000m	12 hours	Chart Recorder
More than 5000m	24 hours	Chart Recorder

Test results should be recorded on the "Pipeline Test Confirmation" form shown in figure 7.1 and submitted to the Branch to support the license application described in section 7.4.

7.4 Licensing Low Pressure Pipelines

Low pressure pipelines which fall within the scope of this manual are licensed by the Branch using the "Pipeline License Application" form shown in figure 7.2. Pipeline information system codes to be used in conjunction with license applications for new pipeline installations are listed in figure 7.3. The license pressure should not be exceeded at any time unless approval in writing has been obtained from the Branch.

7.5 Upgrading Licensed Maximum Operating Pressure

Where a low pressure pipeline is licensed to an operating pressure less than the maximum permitted in CAN/CSA-Z184, the licensed pressure must not be exceeded unless, upon application, written approval has been obtained from the Branch to increase the pressure. An application to increase the operating pressure should be based solely on safety considerations and should consider such factors as material properties, the maximum hoop stress rating for the material, the original test pressure (should be at least 1.4 times the higher the operating pressure being considered), the service history of the pipeline system and the projected service life of the pipe material.

7.6 Interconnecting Low Pressure Pipelines With Different Maximum Operating Pressures

Where it is proposed to connect a new low pressure pipeline to an existing low pressure pipeline and the new pipeline could be licensed to higher M.O.P. than the existing pipeline, the lower of the two maximum operating pressures must be used for both pipelines unless:

(a) the installation of a pressure regulating station between the two pipelines can be justified, or

(b) the M.O.P. of the existing pipeline can be upgraded in accordance with section 7.5.

Alberta

TRANSPORTATION AND UTILITIES
GAS DISTRIBUTION BRANCH

PIPELINE TEST CONFIRMATION

(FOR GAS DISTRIBUTION PIPELINES
OPERATING AT 700 KILOPASCALS OR LESS.)

PIPELINE OWNER _____

ADDRESS _____ TEL. NO. _____

PIPELINE TEST INFORMATION															
FROM LOCATION					TO LOCATION					PIPELINE SPECIFICATIONS			TEST DATA		
LS	SEC	TWP	RGE	M	LS	SEC	TWP	RGE	M	LENGTH (M)	O.D. (MM)	TYPE (P or S)	PRESSURE (KPA)	MEDIUM (SPECIFY)	DURATION (HRS.)

I HEREBY CERTIFY THAT THE TEST INFORMATION SPECIFIED ABOVE IS ACCURATE AND THAT TEST PROCEDURES USED COMPLY WITH THE RURAL GAS REGULATION.

SIGNATURE

NAME (PRINT)

REPRESENTING

TEL. NO.

Alberta

TRANSPORTATION AND UTILITIES
GAS DISTRIBUTION BRANCH

PIPELINE LICENSE APPLICATION

(FOR GAS DISTRIBUTION PIPELINES OPERATING AT 700 KILOPASCALS OR LESS)

PAGE _____ OF _____

LICENSE NUMBER	U

INFORMATION INSTRUCTION CODE

ADD INFORMATION ☐ CHANGE INFORMATION ☐

TYPE OF APPLICATION

☐ APPLICATION FOR A LICENSE

☐ APPLICATION TO AMMEND LICENSE NO U_____

APPLICANT		APPLICANT'S AGENT	
ADDRESS		ADDRESS	
CITY, TOWN OR VILLAGE	POSTAL CODE	CITY, TOWN OR VILLAGE	POSTAL CODE
SIGNATURE FOR APPLICATION	DATE YR. MO. DAY	PERSON TO CONTACT REGARDING APPLICATION	TELEPHONE

LINE NO.	FROM LOCATION					F C	TO LOCATION					F C	LENGTH (km)	O.D. (mm)	WALL THICKNESS (mm)	MATERIAL	TYPE	GRADE	M.O.P. (kPa)	EXTERNAL COATING	JOINTS	STATUS	YEAR
	LS	SEC	TWP	RGE	M		LS	SEC	TWP	RGE	M												

NOTE: ALL DATA TO BE TYPED IN 10 PITCH

CLEARED FOR APPROVAL ➧ SIGNATURE _____ DATE YR. MO. DAY _____

LICENSE APPROVAL ➧ SIGNATURE _____ DATE YR. MO. DAY _____

UT - GD.013

FIGURE 7.3

PIPELINE INFORMATION SYSTEM CODES

TABLE 1: FACILITY CODES

Facility	Code
Customer	CO
Meter/Regulator Station	MR
Meter Station	MS
Pipeline	PL
Regulator Station	RS
Gas Well	WE

TABLE 2: MATERIAL CODES

Material	Code
Polyethylene	P
Steel	S

TABLE 3: POLYETHYLENE RESIN TYPE CODES

Resin	Code
Marlex TR418 Orange	AF
Chevron 9300 Orange	AK
Sclair 35B	AM
Marlex 8000	AN

TABLE 4: POLYETHYLENE GRADE EXTRUDER CODES

Extruder	Code
Maple Leaf Plastics Inc.	E
Phillips Driscopipe Inc.	K
Du Pont Canada Inc. (Wiik & Hoeglund)	T

NOTE: For grades of polyethylene gas pipe, specify extruder code followed by pipe series or SDR number.

TABLE 5: EXAMPLE OF CODES FOR TYPE AND GRADE OF STEEL PIPE

Pipe Specification	Type	Grade
AP1, 5L, Grade A	5L	A
ASTM A53, Grade A	A53	A
CSA, Z245.3 Grade 42, Category 1	Z245.3	42 1

NOTE: The above method is used to abbreviate and code steel pipe. An application for a license should utilize a similar coding system which will clearly identify the specification, type and grade of any steel pipeline.

TABLE 6: JOINT CODES

Type of Joint	Code
Butt Fusion	B
Flanged	F
Mechanical Coupling	M
Socket Fusion	S
Threaded	T
Welded	W

TABLE 7: STATUS CODES

Status	Code
Abandoned	A
Operating, or to be operated	O
Removed	R

8. Pipeline Surveys and Plant Location Records

8.1 General

Buried distribution pipelines must be accurately surveyed and plotted on plant location records for a number of reasons, including the following:

(a) To permit the pipeline to be located for leak detection, future tie-ins, and other general operating purposes.

(b) To permit pipeline locations in order that ground disturbances by third parties (or by the distributor) will not cause damage to the pipeline.

(c) To permit the right-of-way for the pipeline to be accurately registered against the appropriate land title.

The second factor listed is obviously the most important since it involves a high degree of potential for loss of life, personal injury, and/or property damage. Accordingly, it is necessary to utilize a considerable degree of care in designing a pipeline route, ensuring that the design route is adhered to through a pre-construction survey, accurately measuring and calculating the actual location of the buried pipeline through recognized survey techniques and, finally, preparing plant location records to serve as a permanent record of pipeline locations.

8.2 Pre-Construction Surveys

A pre-construction survey should be carried out to ensure that:

(a) Pipelines and plant will be located in accordance with design plans.

(b) All other buried pipelines and cables to be crossed are accurately located.

(c) Tie-in points to the existing mains are in accordance with designs.

(d) Any specific requirements in a utility right-of-way agreement, such as routing of pipelines in accordance with a landowner's specifications, are followed.

(e) The person undertaking construction of the pipelines and plant is provided with a surveyed and staked-out route to follow in order that deviations from design plans are minimized.

Where a pre-construction survey reveals that a more practical and efficient routing is available, the surveyor may stake this alternative routing provided that it falls within the limitations of the utility right-of-way agreement, the permit issued by the Energy Resources Conservation Board, and the construction approval issued by the Branch.

8.3 As-Built Surveys

Following construction, the actual location of a buried distribution pipeline should be accurately surveyed as soon as possible using reliable equipment and proven methods. Due to the additional potential hazard which exists in high pressure pipelines, the survey standards for such pipelines must be more precise and, accordingly, the survey should meet legal survey standards. The respective standards for as-built surveying of each type of pipeline are as follows:

8.3.1 High Pressure Pipelines

(a) The survey equipment to be used must be capable of achieving the accuracy required for legal surveys. A closure accuracy of 1 in 2500 must be adhered to.

(b) Distances and bearings along the pipeline's route between transit stations, the intersections of property lines, and right-of-way boundaries must be shown.

(c) A tie to the North East (NE) corner of every section must be shown. If there is no survey evidence in these locations, the tie can be shown to the closest evidence available. These distances and bearings should be referenced to the existing survey systems.

(d) All high pressure risers must be identified and tied to the nearest survey evidence.

(e) Where the ditch line is not visible at the time of survey, the pipeline must be located with a dependable pipe locating device.

(f) The pipeline should always lie within 1 metre horizontal distance of the line of survey, except where a pipeline has been placed in an irregular arc (e.g. plowed aluminum pipeline) in which case the pipeline must lay within 3 metres horizontal distance of the line of survey. The pipeline must be shown within the correct parcel of land at all times.

(g) The survey plan must be drawn to a minimum scale of 1:10 000 with enlarged details where necessary.

8.3.2 Low Pressure Pipelines

(a) The survey equipment to be used must be capable of achieving the accuracy described below. A closure accuracy of $\pm$ 15 metres must be adhered to.

(b) Distances and bearings along the pipeline route between turning points and property lines must be shown on survey plots, except in subdivided areas where co-ordinate ties of all turning points to existing survey evidence are more practical.

(d) A tie to the North East (NE) corner of every section must be shown or, if more practical, to the closest existing survey evidence that is part of the survey system.

(d) Both ends of the pipeline being surveyed must be tied into the nearest available survey evidence.

(e) Where a definite ditch line is not visible at the time of survey, the pipeline must be located with a dependable pipe locating device.

(f) The actual location of the pipeline should always lie within 5 metres horizontal distance of the line of survey provided that the pipeline is shown within the correct parcel of land at all times.

(g) The survey must be drawn on a survey plot at a minimum scale of 1:20 000 with enlarged details where necessary. A typical survey plot is illustrated in figure 8.1 for reference.

8.4 Plant Location Records

The location of distribution pipelines or other plant which is buried or installed above-ground must be accurately recorded for the reasons described in section 8.1 and, in particular, to ensure against the possibility that buried pipelines cannot be located in a field survey.

Plant location records should be prepared to a high quality to reflect the extensive period of time they will be in use and should be based on minimum and consistent standards for scale, symbols and quality.

A complete description of the Branch's standards for plant location records can be found in appendix C.

8.5 Alberta Low Pressure Mapping Series

The Alberta Low Pressure Pipeline Mapping Series is designed as a public information system which shows the recorded location of pipelines licensed by the Branch under section 7.4. The map of Alberta in figure 8.2 shows those areas of the province that are covered by the mapping series which is broken down into specific map sheet areas equivalent to the 1:50000 National Topographic Series (NTS) mapping grid. Each map sheet covers approximately six townships between 0°30′ longitude and 0°15′ latitude. Lands adjacent to the fifth meridian may be distorted because of the merging of the two 10° Universal Transverse Mercator (UTM) mapping areas.

Rural gas distributors' franchise areas are identified in this series by a heavy solid line. Low pressure pipelines not specifically identified by a name or license number are owned and operated by the distributor. Rural subdivisions are not named but most hamlets and some localities are named. If the hamlet or locality is not served by the local distributor, the gas utility serving the area is identified. Pipelines owned and operated by a company or person other than the distributor are identified by a license number and name when possible.

The crosshatched areas identify locations where there are pipelines within rural subdivisions and unincorporated urban areas. When a three digit numeral appears in or adjacent to these crosshatched areas it refers to the distributor's as-built drawing number suffix. The incorporated urban areas are outlined with a heavy dashed line. The names of villages, towns and cities and their gas distributors are also identified in or next to urban areas. The solid circles at the end of the pipeline symbolize the service locations. This symbol shows an irrigation outlet, grain dryer location, domestic, commercial or industrial service. A typical map sheet is illustrated in figure 8.3.

To maintain the "one window" approach for distribution of information to the public, the Energy Resources Conservation Board distributes copies of the Alberta Low Pressure Mapping Series from its Calgary records office.

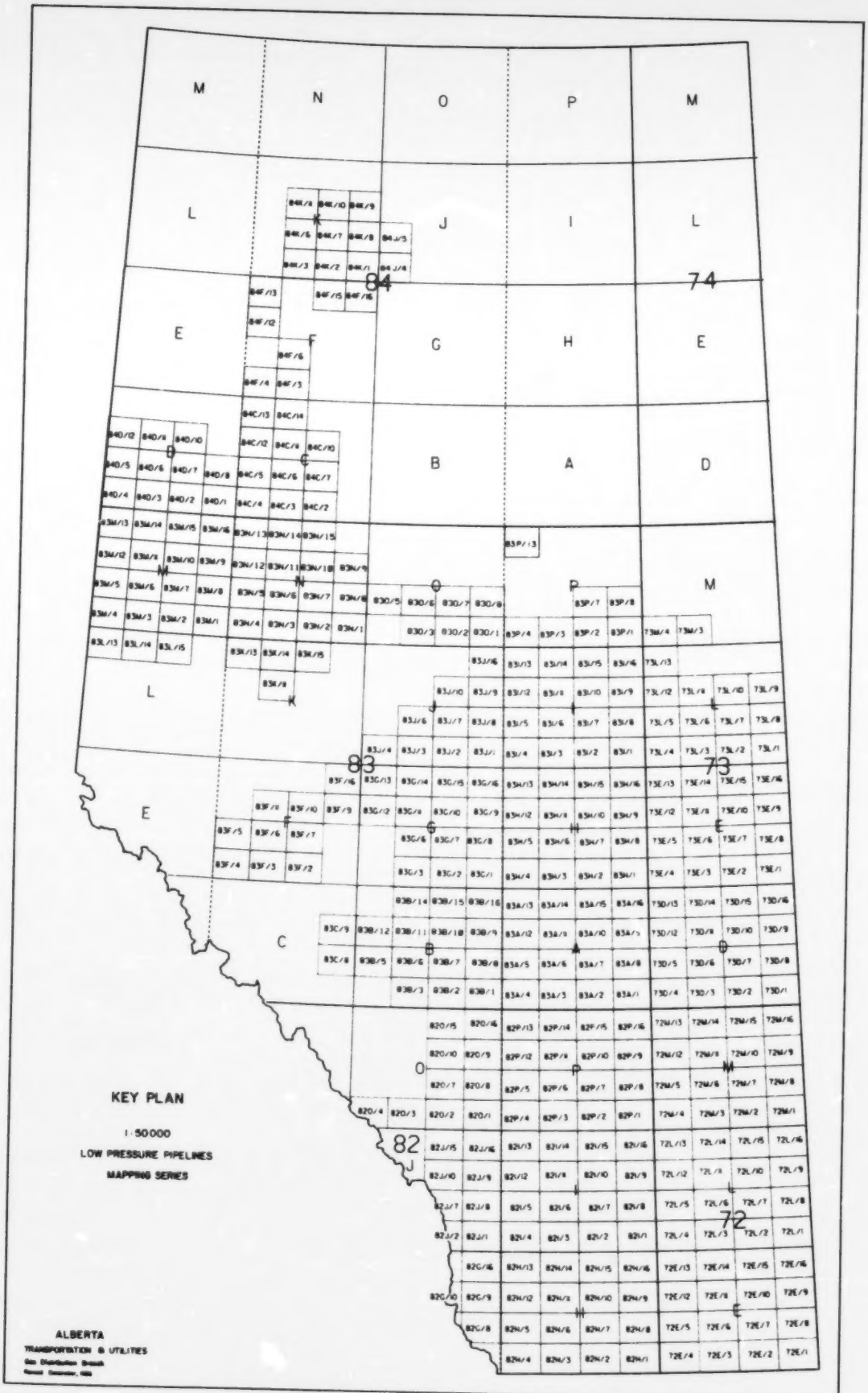
AS-BUILT SURVEY PLOT

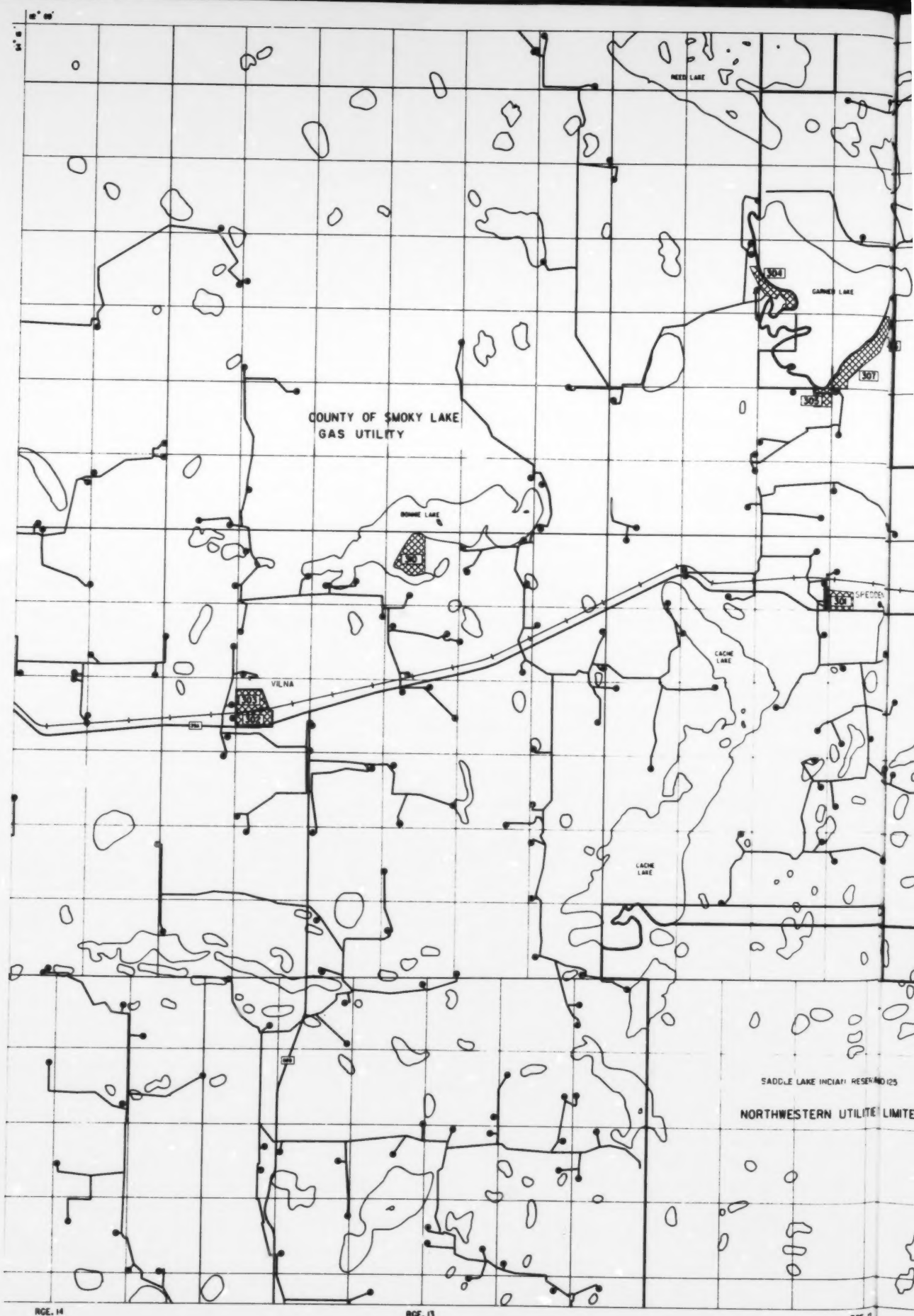
Distributor _____ Plotted by _____ Date _____

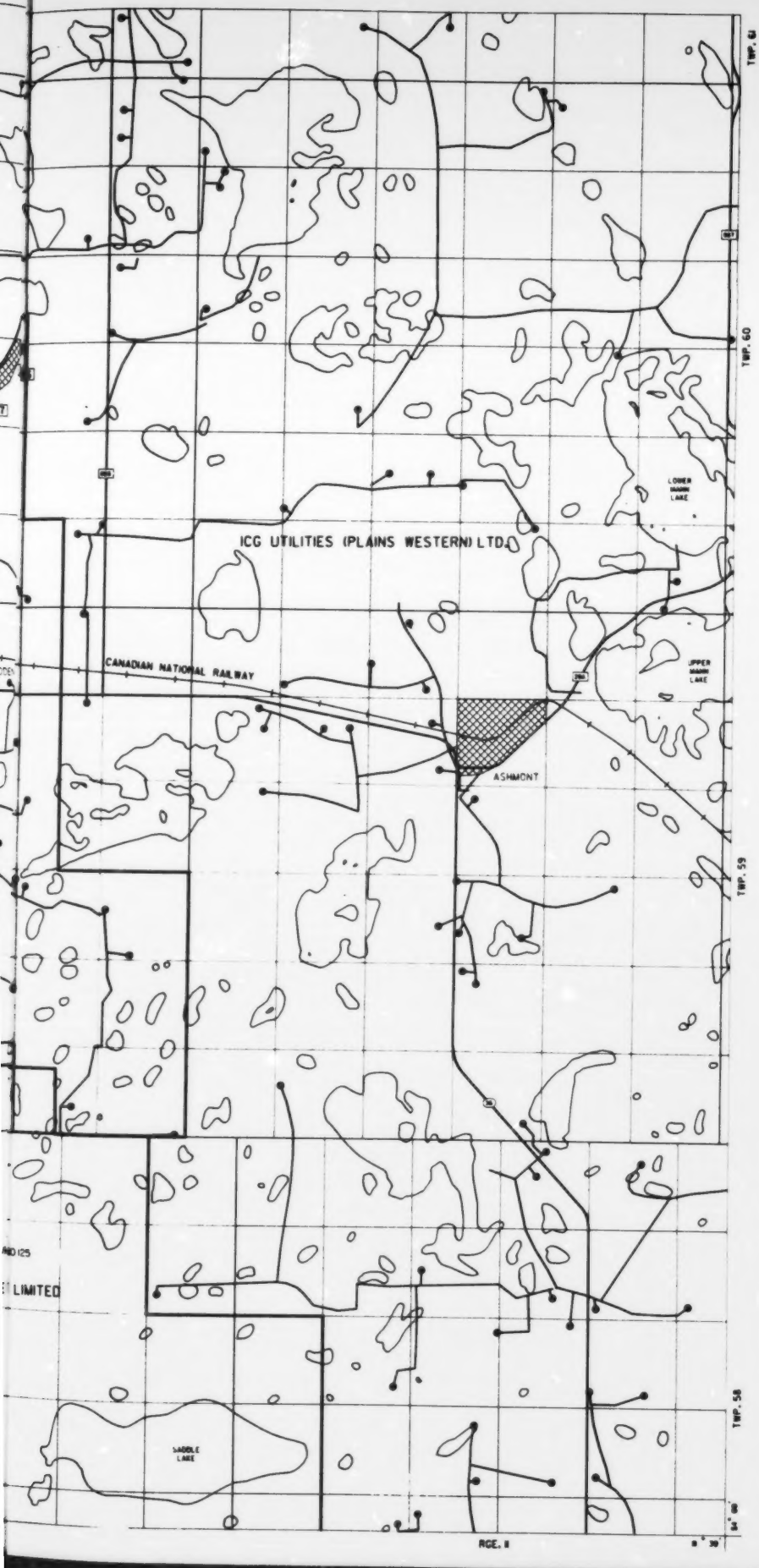
Line Segm.	Bearing Azimuth	Length metres	Cos	Sin	LAT. N/S	DEP. E/W	Line Segm.	Bearing Azimuth	Length metres	Cos	Sin	LAT. N/S	DEP. E/W
Subtotal							Subtotal						
							Total						

Rge. ____

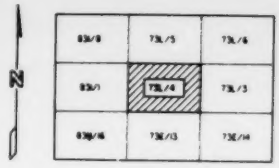
Twp. ____


KEY PLAN
1:50000
LOW PRESSURE PIPELINES
MAPPING SERIES
ALBERTA
TRANSPORTATION & UTILITIES

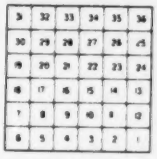

REED LAKE
304
GARNER LAKE
307
COUNTY OF SMOKY LAKE
GAS UTILITY
BONNIE LAKE
VILNA
CACHE LAKE
CACHE LAKE
SADDLE LAKE INDIAN RESERVE 125
NORTHWESTERN UTILITIES LIMITE
RGE. 14
RGE. 13



SHEET REFERENCE



INDEX TO ADJOINING MAPS



TYPICAL TOWNSHIP SECTION NUMBERING

LEGEND

- NATURAL GAS DISTRIBUTORS FRANCHISE BOUNDARY
- LEGAL BOUNDARY (CITIES, TOWNS, VILLAGES, PARKS, RESERVES, ETC.)
- SUBDIVIDED AREA
- GAS SERVICE LOCATION (ALL SERVICES EXCEPT HIGH AND PRIVATELY OWNED PIPELINES)
- LOW PRESSURE GAS DISTRIBUTION PIPELINE
- ABANDONED PIPELINE

NOTES

1. DISTRIBUTOR TO BE CONTACTED FOR PIPELINE LOCATION INFORMATION IN SUBDIVIDED AREAS.
2. DISTRIBUTOR TO BE CONTACTED FOR FIELD LOCATION AND UP-TO-DATE PIPELINE INFORMATION PRIOR TO EXCAVATING.
3. LOW PRESSURE PIPELINE OPERATORS, OTHER THAN THE AREA DISTRIBUTOR, ARE SPECIFICALLY IDENTIFIED.
4. OWNERSHIP OF PRIVATELY OPERATED PIPELINES SHOULD BE DETERMINED FROM OTHER APPROPRIATE SOURCES.

NO	TOWNSHIPS	DATE	BY
	ORIGINAL ISSUE	NOV./985	N/A

REVISIONS

LOW PRESSURE NATURAL GAS DISTRIBUTION PIPELINES (MOP = 700 kPa)

GENERAL LOCATIONS

Alberta
TRANSPORTATION AND UTILITIES
Gas Distribution Branch

Kilometres

SHEET NO.
73L/4 -UT

9. Operations and Maintenance

9.1 General

Good operation and maintenance practices are essential for the effective delivery of natural gas service to consumers, for the safety of consumers, utility employees and the general public, and to maximize the useful operating life of pipelines and plant. Each rural gas distributor has the option of expanding its operations and maintenance program to include such services as appliance installation and repair; however, each distributor is, as an absolute minimum, responsible for the safety of natural gas transportation and delivery and must include in its program sufficient practices, procedures and resources to cover:

(a) operation, inspection, maintenance and repair of all pipelines and plant it owns between the point where it receives natural gas from a supplier to a point(s) where it delivers natural gas to its consumer(s).

(b) notwithstanding its lack of ownership of pipelines and plant installed downstream of the consumers' meters, provision of emergency response service to a level which will ensure as far as is reasonably possible that persons and property are not exposed to danger.

It is the Branch's responsibility with respect to the public interest to ensure as far as is reasonably possible that rural gas utilities are operated and maintained in accordance with these minimum standards.

9.2 Operations and Maintenance Manuals

A rural gas distributor must develop and keep up-to-date an operations and maintenance manual to direct its employees in the practices and procedures to be used in the areas of operation, inspection, maintenance, repair, emergency response, tools and equipment, and records.

Operations and maintenance manuals must be filed with the Department except in cases where the distributor has adopted without change the "Guidelines for Operation and Maintenance Practices in Alberta Natural Gas Utilities" which has been co-sponsored by the Branch and the Federation of Alberta Gas Co-ops Ltd. However, where a distributor deletes or amends any part of this manual, the distributor must advise the Department in writing of the deletion or amendment which has been made. Although the Department recognizes the flexibility and alternative approaches which exist in the preparation of operations and maintenance manuals, it may request that a manual be amended where it is apparent that good operation and maintenance practices are not being addressed.

9.3 Training

While a complete operations and maintenance manual will guide employees in the practices and procedures to be used, it is the distributor's responsibility to ensure that employees receive adequate training in any work they will be expected to undertake. Employees must be trained so that they are fully competent and qualified to carry out any tasks which are assigned to them including the following areas as a minimum:

(a) properties of natural gas;

(b) emergency response;

(c) use and care of tools and equipment;

(d) operation, inspection, maintenance and repair of pipelines and plant;

(e) fundamentals of natural gas measurement;

(f) interpretation and use of plant records;

(g) use of records and reports;

(h) use of codes, standards and regulations.

9.4 Pipeline Location for Third Parties

Rural gas distributors must be prepared on reasonable notice to provide a pipeline location service upon request and at no charge in cases where a person proposes to carry out a ground disturbance which may cause damage to a pipeline. This service necessitates three basic steps:

(a) obtaining and registering utility rights-of-way or other suitable instruments with the Land Titles Office in order that the existence of the distributor's pipeline may be evident from a review of land titles;

(b) preparing and filing accurate plant location records with the Branch and/or with the Energy Resources Conservation Board (high pressure pipelines only) in order that the existence of the distributor's pipelines may be evident from a review of pipeline information systems (see section 8.5);

(c) at the reasonable request of a person proposing to cause a ground disturbance which may affect the distributor's pipeline(s), the distributor must accurately locate and flag its pipeline(s) and take any additional steps which are necessary to ensure that the ground disturbance does not cause damage to the pipeline(s). These additional steps may include supervising the exposure of buried pipelines to ensure that the methods used to carry out the exposure will not cause damage to the pipeline. The need for a distributor to provide supervision reflects the distributor's expertise with buried gas pipelines compared to the more limited expertise which the person carrying out the ground disturbance may have.

Location and, if necessary, supervision services are an inherent responsibility of the distributor, and to maximize co-ordination in cases where a ground disturbance may affect the distributor's pipeline, these services should be provided at no cost to the person requesting the service.

Appendix A
Degree-Day Method For Establishing Peak Hour Design Loads

A "degree-day" (DD) is essentially a unit of measurement which identifies the difference in degrees Celcius (°C) *between a selected base temperature* of 18°C and the actual mean daily air temperature in a 24-hour cycle. So, if the mean temperature for a 24-hour cycle is one degree below the mean, then:

DD = (Base temperature − mean temperature)
= (18°C − 17°C) = 1 degree-day

With a mean temperature of −40°C in mid-winter:

DD = (Base temperature − mean temperature)
= (18°C − (−40°C)) = 58 degree-days

The number of degree-days in any specific period (e.g. a month or a year) is simply tabulated by adding the number of degree-days in each 24-hour cycle for that period.

The application of the degree-day concept to peak design loads is limited to existing consumers with a billing history and whose consumption is primarily for space heating. It relates the consumption to the number of degree-days during a specified heating period to establish the peak hourly load for an individual consumer. The total demand on a system is then extrapolated by applying appropriate coincidence factors as described in subsection 4.2.3.

The peak hour design load for an individual consumer is based on the coldest day that would normally be expected during a heating season, usually −40°C. It recognizes that, although this low temperature will likely be accompanied by a wind-chill factor, additional heat should be generated by occupants and appliances to essentially compensate for this secondary factor.

The following hypothetical example illustrates the step-by-step method of calculating the approximate peak hourly design load for an individual consumer using the degree-day method:

1. **Energy Consumption and Degree-Day History**

Data needed includes the consumer's natural gas energy consumption and the number of degree-days at his location for the same annual billing period.

Period	Consumption (GJ)	No. of Degree-Days (DD)
JULY	7.0	57
AUG.	4.6	47
SEPT.	17.6	368
OCT.	23.2	550
NOV.	40.6	800
DEC.	48.0	1157
JAN.	38.2	880
FEB.	35.2	870
MAR.	21.0	596
APR.	17.6	416
MAY	9.0	187
JUN.	6.6	135
	268.6	6063

So, for this particular consumer, the peak design load may be estimated using the energy consumption of 268.6 GJ and a degree-days total of 6063 DD. Note that the monthly consumption to degree-day ratio will not always be consistent due to the timing of meter reads and other factors. This is why the estimate should be based on annual data.

2. Assume:
   - A. Average heating value of gas: 1000 Btu/ft^3 or 1.055 GJ/1000 ft^3
   - B. Coldest day experienced: −40°C, all day.
   - C. Furnace cycling: equal (50%) on-off.
   - D. Impact of other appliances: nominal
3. Convert natural gas energy consumption to volume:

   Assumption: 1000 ft^3 = 1.055 GJ

   (Number of GJ consumed) X $\frac{1000}{1.055}$ $\frac{(ft^3)}{GJ}$ = cubic feet of gas used

   eg: 268.6 (GJ) X $\frac{1000}{1.055}$ $\frac{(ft^3)}{GJ}$ = 254600 ft^3
4. Calculate the average volume per degree-day (for this hypothetical case):

$$\frac{\text{Total volume of gas used over period}}{\text{Number of degree-days in same period}} = \frac{ft^3}{DD}$$

eg: $\frac{254600}{6063}\ \frac{(ft^3)}{DD} = 42\ \frac{(ft^3)}{DD}$

5. Calculate the degree-day equivalent for one hour on −40°C day.

$$\frac{18 - (\text{Mean Temperature})}{\text{number of hours in a day}} = \frac{\text{degree-day}}{\text{hour}}\ \frac{(DD)}{hr}$$

eg. $\frac{18 - (-40)}{24}\ \frac{(DD)}{hr} = 2.42\ \frac{DD}{hr}$

6. Calculate the average volume for an equivalent degree-day/hour:

   (Average volume per degree-day) X (Degree-day per hour equivalent)

   = average consumption per hour on a −40°C day.

   eg: 42 ft^3/DD X 2.42 DD/hr = 101.50 ft^3/hr

7. Calculate average peak hour design load, recognizing the cyclic operation of the furnace:

   Assumption: Furnace cycle 50 % on − 50 % off

   Peak Design Load

   $$= \frac{\text{Average consumption per hour on } -40°C \text{ day}}{\text{Proportion of time that furnace is on}}$$

   eg: $\frac{101.50\ (ft^3)/hr}{0.50} = 203.00\ ft^3/hr$

   Therefore, the estimated peak design load for this consumer would be rounded to 200 ft^3/hr.

It must be noted that the number of degree-days for any specific time period (day, month or year) will differ between periods and between locations throughout the province. For the 24 meterological stations maintained in Alberta by Environment Canada, the annual degree-days may range from a typical 5000 in southern Alberta to perhaps 7500 in the extreme north of the province. What this 50 percent increase in annual degree-days means is that a consumer in the north with an identical home, appliances and furnace/thermostat utilization as the consumer in the south would consume about 50 percent more energy during that year. However, with the same characteristics, both consumers would still have similar peak hour design loads.

A table of typical annual degree-days for a calendar year at each of the 24 meteorological stations in the province is illustrated for information only in figure A1. Actual degree-day data is available from Environment Canada for specific locations and for selected billing periods. This date may then be used to complete the above calculations for any specific consumer and avoid the need to conduct an updated load survey for that consumer.

Figure A1

Typical Annual Degree-Days at Alberta Meteorological Stations

Location of Station	Annual Degree-Days
Banff	5670
Brooks	5282
Calgary	5348
Cold Lake	6195
Coronation	5899
Edmonton	5525
Leduc	6048
Namao	5760
Edson	6084
Fort Chipewyan	7663
Fort McMurray	6726
Grande Prairie	6150
High Level	6980
Jasper	5554
Lethbridge	4725
Medicine Hat	4868
Peace River	6449
Pincher Creek	4972
Red Deer	5852
Rocky Mountain House	5734
Slave Lake	6312
Suffield	5117
Vermilion	6107
Whitecourt	6186

Appendix B

Control Areas For Low Pressure Pipelines Paralleling Local Municipal Roads Administered by Counties and Municipal Districts

For the purpose of proposed low pressure gas pipeline installations parallel to local municipal roads, a designated control area as described below should be utilized by distributors and municipal authorities on a consultative and co-operative basis to facilitate road planning operations such that unnecessary relocation or lowering of pipelines due to road alterations, widening or relocation is avoided. However, the defined width of the control area should not be interpreted as a mandatory set-back distance from the municipal roadway. Instead, it represents the area within which the municipal authority should be consulted so that it may define its requirements and protect its interests with regard to roadway development or potential future expansion of existing roadway development.

The control area for each type or category of municipal roadway is defined as a distance from the centre line of the roadway which, unless otherwise identified, is represented by the centre of the original road allowance. For any control area in question, the municipal authority should, upon request, provide information for those roadways where the centre line is to be otherwise defined.

The defined control areas are:

(a) 30 metres from the centre line of internal subdivision roads and service roads;

(b) 40 metres from the centre line of the roadway for local municipal roads on the statutory road grid including forced roads, road diversions and service roads along highways which supplement the statutory road grid;

(c) 50 metres from the centre line of the roadway for municipal roads designated by the department as Secondary Roads or Park Roads;

(d) 100 metres from the centre line of any municipal roadway in areas of extreme adverse terrain conditions such as ravines and steep sidehills.

For each proposed pipeline installation that will be located within a control area, the distributor is responsible for submitting details of the proposal to the municipal authority. The submission should, as a minimum, identify the proposed pipeline route relative to all legal property boundaries within the control area. The municipal authority should then either endorse the proposal or confirm to the distributor that the proposed pipeline route should be amended so as not to conflict with future road planning. Where the municipal authority is unable to endorse the proposal, it should provide the distributor with its reasons for not doing so. Generally, these may include any of the following:

(i) the possibility of widening of the road allowance to the width normally acquired by the municipal authority for the standard of the road in question;

(ii) the need for an access control reserve buffer adjacent to the widened road allowance boundary in areas of existing or anticipated subdivisions;

(iii) any additional clearance required beyond the typical boundaries of the road allowance to allow for uneven terrain conditions. The additional clearance required should be estimated by the municipal authority and, if the distributor feels that this estimate is excessive for the terrain conditions in question, it may request that the requirement be reconsidered by the municipal authority on the basis of surveyed topographical information. The distributor would be required to submit such information to the municipal authority in support of this request.

In advising the distributor of its reasons for recommending an amendment to the pipeline route, the municipal authority should also recommend an alternative route which will not conflict with future road planning. If possible, the distributor should attempt to utilize this amended route. However, where it is impractical to do so (e.g. landowner consent cannot be obtained), the distributor and the municipal authority should be prepared to co-operate in establishing a third route which may be reasonably satisfactory to both parties. In such cases, the distributor should be prepared to bear the cost of pipeline relocation where the conflict identified by the municipal authority in its response to the distributor's submission does in fact occur in future road improvements.

Appendix C
Standards For Plant Location Records

Plant location records should be compiled from standard size 22 inches by 34 inches mylar of 0.003 inches thickness with matt finish both sides. Pre-printed blank mylar paper may be supplied by the Branch.

Plant location records should comprise the following individual types of drawings:

(a) Key plans — to provide an overall pictorial view of the layout of a distribution system. This plan may be drawn to any convenient scale. (See Figure C1.)

(b) Legend and Specification Plan — to outline the standard symbols to be used in all township, urban, and detail plans, and standard technical specifications for all line pipe. (See Figure C2.)

(c) Township plans — to provide an accurate record of the location of all pipelines and plant installed in a specific township within the franchise area. (See Figure C3.)

(d) Detail plans — this type of plan should provide larger scale details of pipelines and plant installed in urban areas or subdivisions, enlarged details from township plans, or details of typical crossings and above ground appurtenances. (See Figure C4.)

Drawings should be drafted to a scale of 1:20 000 for all township drawings and to an appropriate standard scale for any other type of plan in accordance with CGSB Standard 88-GP-20M (October 1975) as far as is practical and provided that sufficient clarity is achieved:

1:	1 000 000	1:	1 000
1:	500 000	1:	500
1:	250 000	1:	200
1:	200 000	1:	100
1:	100 000	1:	50
1:	50 000	1:	20
1:	20 000	1:	10
1:	10 000	1:	5
1:	5 000	1:	2
1:	2 000	1:	1

A standard system of plan numbers should be used for plant location records as follows:

(a) Drawing numbers for all plans should be preceded with a 4-digit number to identify the distributor.

(b) Key plans should be identified by the series number 100.

(c) Legend and specification plans should be identified by the series number 200.

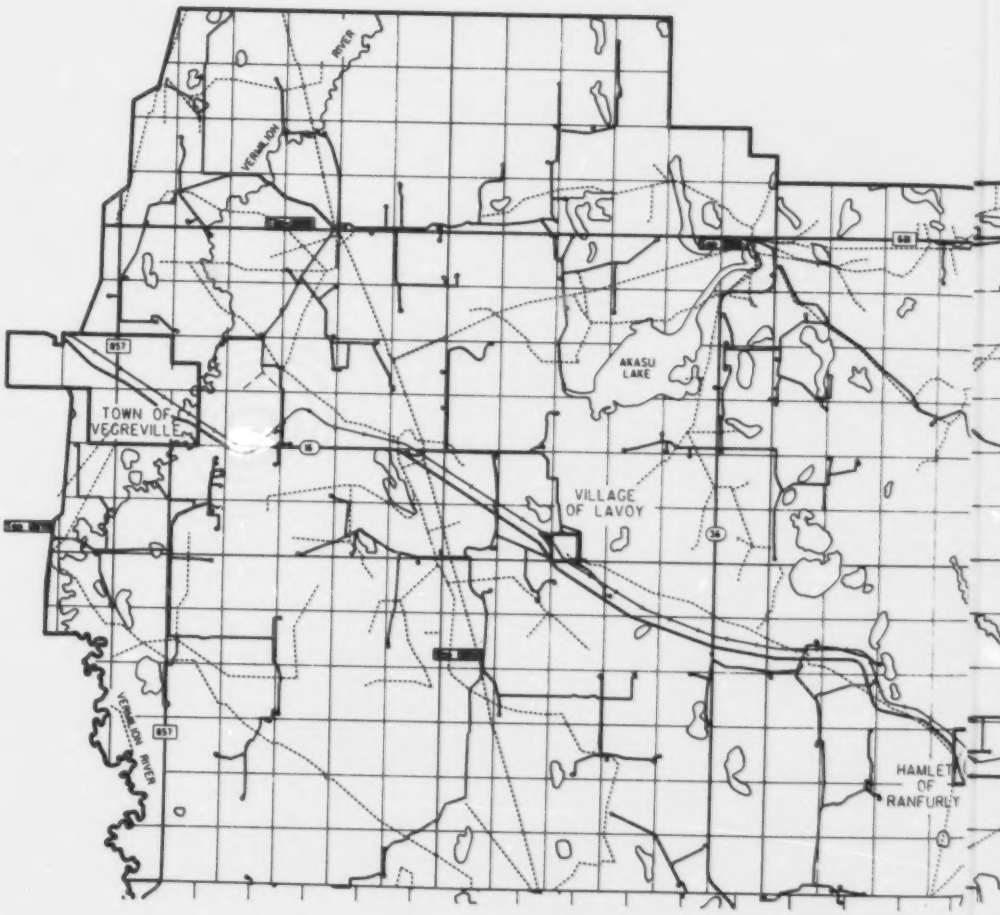
(d) Township plans should be identified by township-range meridian numbers as applicable.

(e) Detail plans or urban areas and subdivision should be identified by the series number 300.

(f) Detail plans of typical crossings and above-ground appurtenances or enlarged details from township drawings, should be identified by the series number 500.

(g) Detail plans of franchise area boundaries should be identified by the series number 700.

Franchise area boundaries should be shown on all key plans and all township plans where the franchise area boundary falls within those townships. Township plans should include such topographical details as highways, railways, roads, waterways, cities, towns, villages, hamlets or any other prominent surface feature as may be necessary or beneficial to the distributor for operation of its distribution system. Township plans should also include the location of all foreign pipelines which should be identified by the name of the owners of those pipelines.



SCALE BAR
0 cm
10
20

RGE. 15 14 13 12

WEST OF 4th MERIDIAN

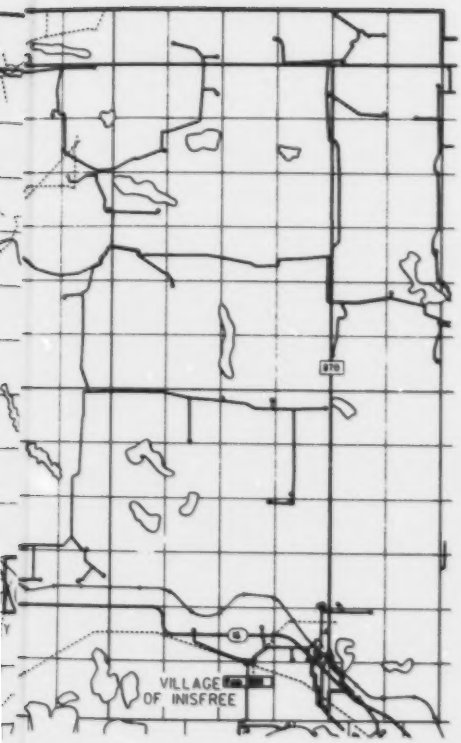
TWP.

N

53

52

51

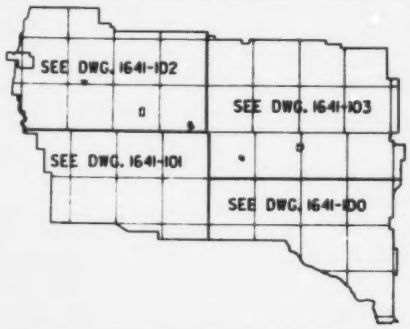


II

AN

52

KEY PLAN



LEGEND

- FRANCHISE BOUNDARY
- CANADIAN NATIONAL RAILWAY
- (43) PRIMARY HIGHWAY
- (727) SECONDARY HIGHWAY

NO.	REVISION	DATE	DWN.	APP.
1	ORIGINAL ISSUE		MLM	MA

EXAMPLE NATURAL GAS CO-OP LTD

KEY PLAN

COMPUTER GRAPHICS CONVERSION

Alberta
TRANSPORTATION AND UTILITIES
Gas Distribution Branch

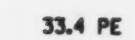
SCALE 1:100000

DRAWING NO. 1641-102

LEGEND/SYMBOLS

Tap Designation

Regulator Station Designation



Pipe Size and Type along route

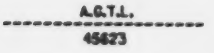
Utility Gas Line

Meter Station

Regulator Station

Tee

Abandoned Pipeline



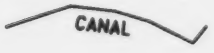
Foreign Pipeline, Name and Licence Number

Railway

Highway, Secondary Highway, All Weather Road

Dry Weather Road

Subdivision, Hamlet and Town



Irrigation Canal

LEGEND/SYMBOLS

Customer

Irrigation Pump

Grain Dryer

Customer - Non Burning

Irrigation Pump - Non Burning

Grain Dryer - Non Burning

Custom)er (Communal Farm

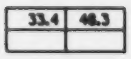
Customer (Multi-meter Set)

Urban Customer/Number of Contracts

Urban Grain Dryer/Number of Contracts

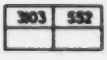
Meter Station

Regulator Station



Change in Pipe Size (mm)

Change in Pipe Material



Change in Maximum Operating Pressure (kPa)

SHEET 2 OF 3

LEGEND/SYMBOLS

Anode

Test Station

Cap

Above Ground Isolation Valve

Below Ground Isolation Valve

Abandoned Pipeline

Foreign Pipeline Crossing

Road Crossing

Railway Crossing

Watercourse Crossing

Gas Well

Oil Well

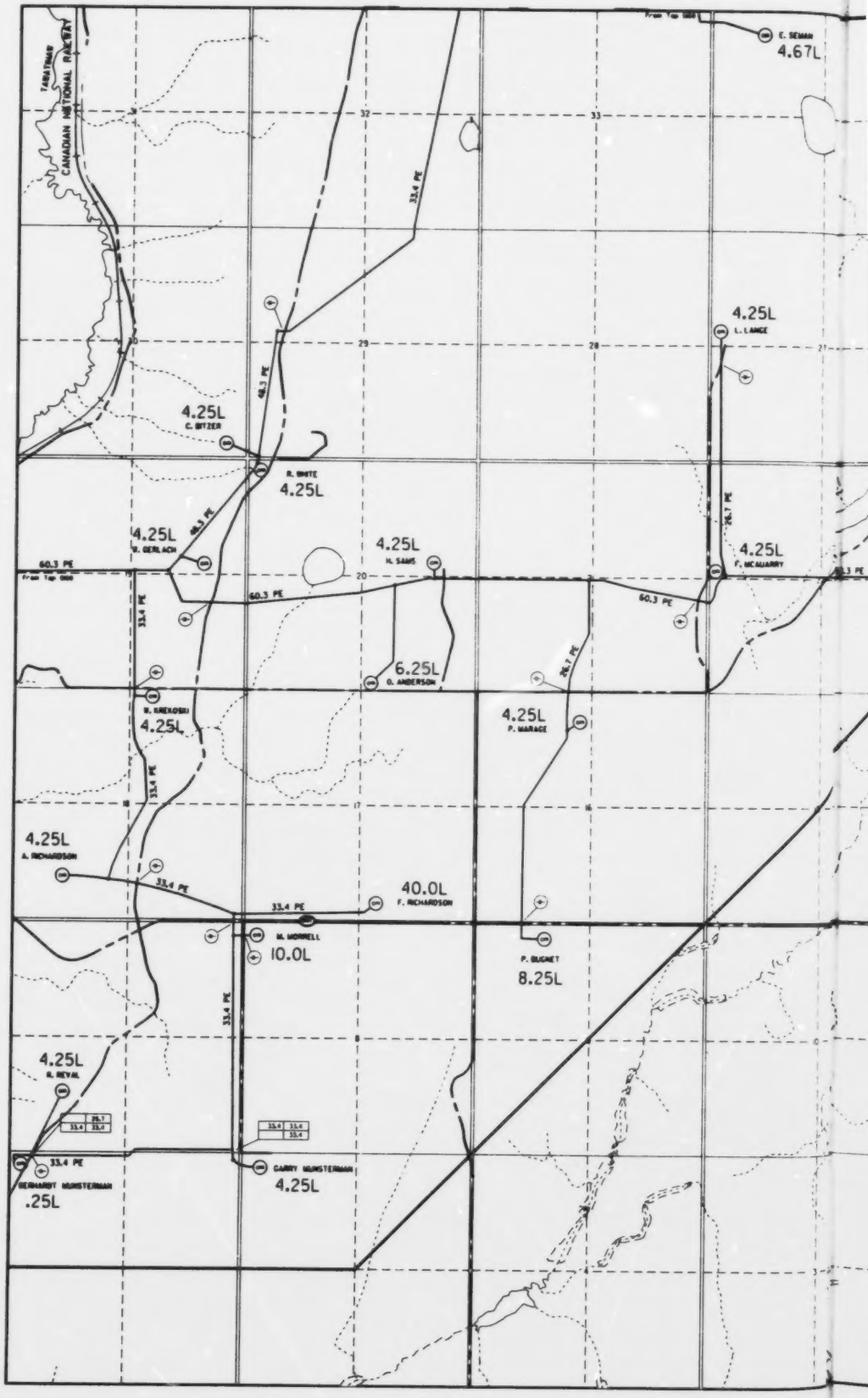
Franchise Area Boundary

Approved Urban Boundary

Federally Owned Land Boundary

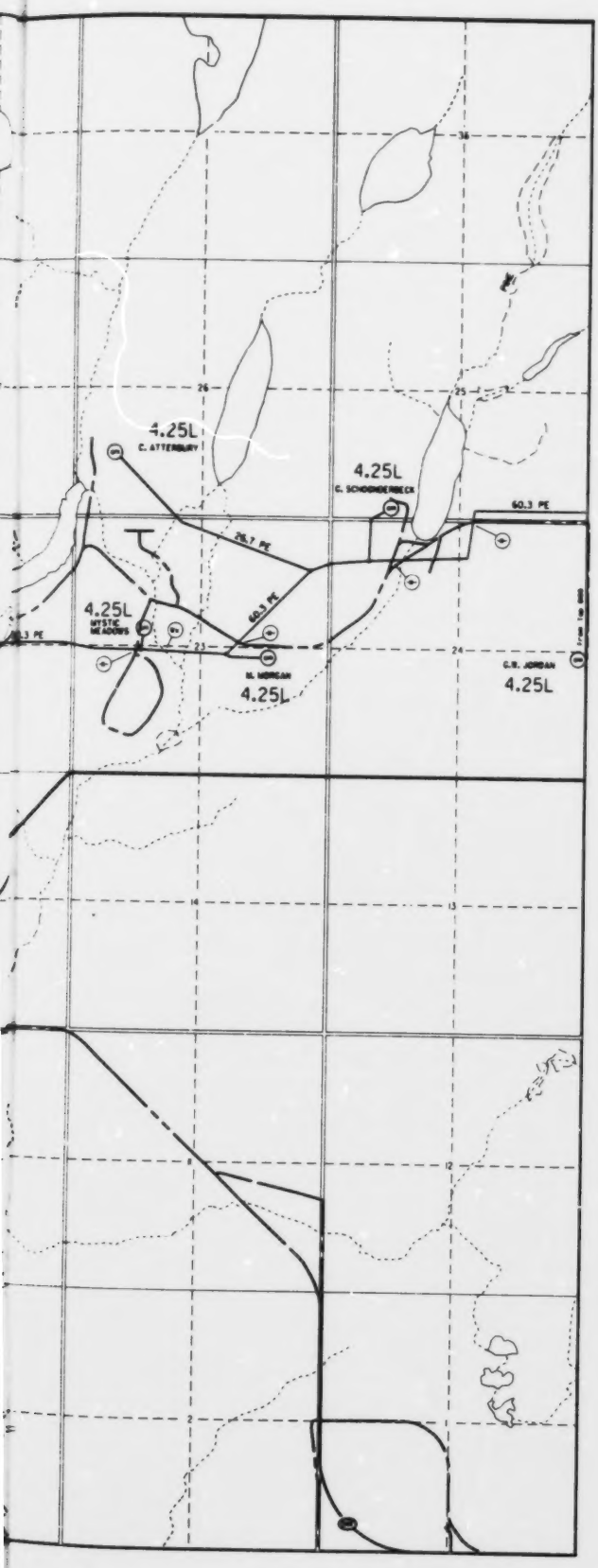
SHEET 3 OF 3

1525-62-23-4



RGE. 23

1525-62-23-4



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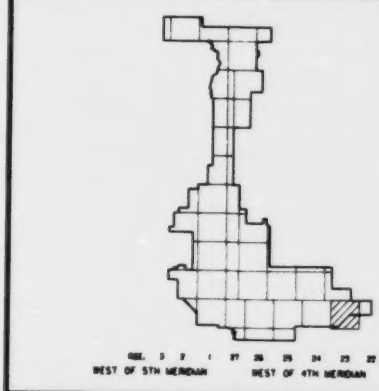
TWP.62

KEY PLAN



NOTES

1. The accuracy of measurement and location of all Co-op pipelines shown on this plan are in accordance with the Energy Resources Conservation Boards Informational Letters numbered I.L. Pl. 75-4 and I.L. Pl. 78-4 as applicable at the date of survey.
2. For enlarged details see drawing no.
3. For typical crossing details see drawing no.
4. For typical regulator stations and block valve details see drawing no.
5. For typical consumer meter installation see drawing no.
6. All dimensions shown hereon are in metres and all pipe sizes are actual outside diameter, expressed in millimetres.
7. All single service lines are 26.7mm unless otherwise noted.

CROSSINGS

1/4 SEC.	TYPE	WIDTH	CASING	COMMENTS

NO.	REVISION	DATE	DWN.	APP.
	REDRAFTED - INCLUDES 1986 CONSTRUCTION	APR/1987	MLM	N/A

SAMPLE NATURAL GAS CO-OP LTD

AS BUILT PLAN

COMPUTER GRAPHICS CONVERSION

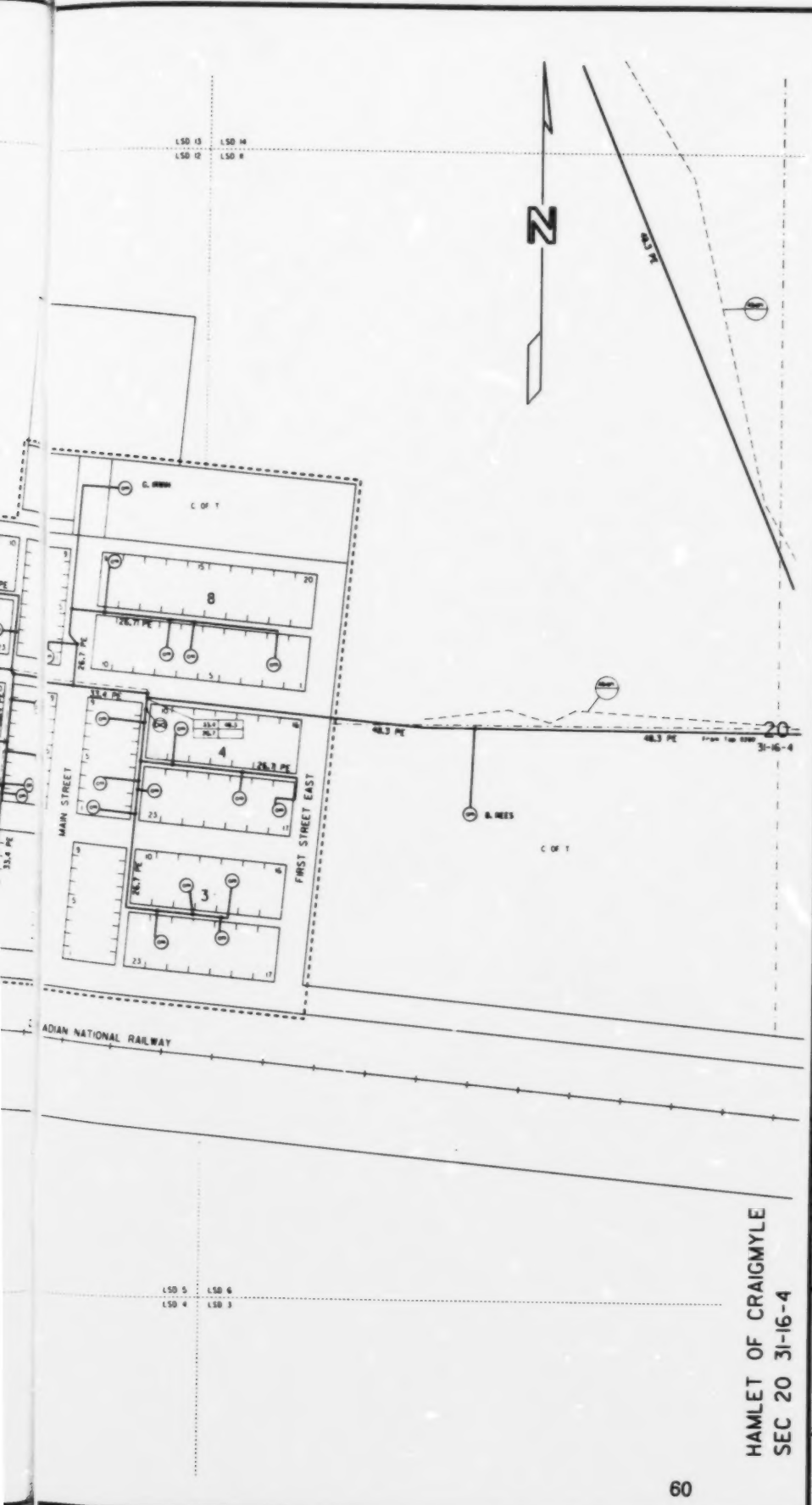
Alberta
TRANSPORTATION AND UTILITIES
Gas Distribution Branch

SCALE 1:20000

DRAWING NO. 1525-62-23-4

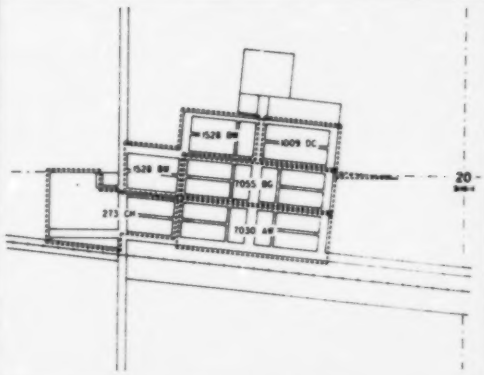
1634-302

1634-302



HAMLET OF CRAIGMYLE
SEC 20 31-16-4

KEY PLAN



CUSTOMER LIST

LOT	BLOCK	PLAN NO	CUSTOMER NAME	LOAD
	C OF T		B. REES	8.30
	C OF T		G. [illegible]	7.73
12	1	2337CH	R. PARSONS	4.00
	9	2337CH	CRAIGMYLE CIVIC CENTER	16.17
5	1	2730CH	A. L. OSLOW	1.98
6	1	2730CH	F. REES	2.48
8	1	2730CH	R. KELSCHENBACH	5.09
14	1	2730CH	R. PARSONS	5.00
3	8	4009DC	G. SHEPPARD (L2)	5.00
5	8	4009DC	A. BERGMAN	5.32
7	8	4009DC	R. OLMSTEAD	5.00
9	8	4009DC	H. FAECHNER	2.35
1	6	5218BW	CRAIGMYLE FARM SUPPLY	8.35
2	6	5218BW	D. REES	3.78
3	6	5218BW	K. HERMANN	5.00
14	6	5218BW	C. SIMPSON	5.52
1	7	5218BW	A. M. WATSON SMITH (L2)	5.00
5	7	5218BW	D. WEST	5.00
7	7	5218BW	CRAIGMYLE PUMPHOUSE	5.00
13	7	5218BW	M. DEIGEL	5.00
15	7	5218BW	D. & C. REES	5.00
22	7	5218BW	Mrs. BLOSS (20-22)	2.26
23	7	5218BW	C. GROVER	6.54
16	1	7030AW	C. GRANGE	5.00
17	1	7030AW	G. LUBBRECHT (12,13)	4.58
14	1	7030AW	C. GROSS	4.58
15	1	7030AW	ALTA. WHEAT POOL (17-18)	4.84
22	1	7030AW	A. HUNTER	3.00
1	4	7055BC	ARMY FAECHNER	5.00
3	4	7055BC	E. C. GROVER (2,3)	5.09
8	4	7055BC	R. OLMSTEAD (8,9)	5.87
9	4	7055BC	H. HAWKE	3.00
17	4	7055BC	H. MACDONOUGH	4.74
19	4	7055BC	ALTA. WHEAT POOL (15,20)	7.20
21	4	7055BC	H. FAECHNER	5.00
1	5	7055BC	K. WALSH	12.80
2	5	7055BC	A.G.T.	3.54
4	5	7055BC	R. OLMSTEAD (3,4)	4.30
8	5	7055BC	UNITED CHURCH (8,9)	8.38
18	5	7055BC	H. OLMSTEAD	7.54
22	5	7055BC	MUNICIPAL DIST. OF STARLAND	5.00
23	5	7055BC	P. D. WALSH	3.54

NOTES

1. All dimensions shown hereon are in metres and all pipe sizes are actual outside diameter, expressed in millimetres.
2. All single service lines are 26.7mm unless otherwise noted.

NO.	REVISION	DATE	DWN.	APP.
1	REDRAFTED - INCLUDES 1986 CONSTRUCTION	MAR/1987	JRD	N/A

EXAMPLE NATURAL GAS CO-OP LTD

AS BUILT PLAN

COMPUTER GRAPHICS CONVERSION

Alberta
TRANSPORTATION AND UTILITIES
Gas Distribution Branch

SCALE 1:2000

DRAWING NO. 1634-302